# ASO VAFB Facility Accommodation Manual

## Astrotech Space Operations, Inc.
## Vandenberg AFB, California Facility

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A SPACEHAB COMPANY

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# ASO VAFB

# Facility Accommodations Manual

Reviewed and Approved by:

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# 1 SCOPE

## 1.1 OBJECTIVES

This Manual describes the facilities, equipment, and services available to customers of Astrotech Space Operations at the Vandenberg AFB, California facility (ASO VAFB), for pre-launch, launch and, as applicable, post flight payload processing. Payload processing refers to the final preparation of spacecraft, upper stages, payload fairings, and related space flight support equipment for launch on either expendable launch vehicles (ELVs) or reusable launch vehicles (RLVs) to include post-flight support of RLV payloads, if applicable. The Astrotech Vandenberg payload-processing complex is located in Vandenberg AFB, California. Astrotech has consistently proven itself as a leader in the commercial space industry and is committed to growth consistent with the future demands of the space lift market.

The buildings encompassed within the Astrotech facility can be operated as a Foreign Trade Zone (FTZ), allowing non-U.S. based customers to ship their spacecraft and Ground Support Equipment (GSE) with less import complications.

This document contains the detailed descriptions and specifications of the Astrotech Vandenberg facilities and equipment. It is intended to provide sufficient information to enable customers and potential customers to make detailed plans for payload processing activities and to consequently document these plans in the Payload Processing Requirements Document (PPRD) or Interface Control Document (ICD), a contract deliverable document.

This Manual also serves as a useful reference for the facilities, equipment, and services available during actual payload processing operations. Customers should also refer to the Astrotech Facility Safety Manual SHI-ASO-M0011 when planning to use the facilities.

The units of measurement used in this document are English (i.e., foot-pound-second) with the equivalent International System of Units (SI) provided in parenthesis (i.e., meter-kilogram-second). All dimensions given are accurate as of the release date of this Manual. In the event that facility dimensions are critical to any payload processing activity, the customer should request verification of the precise measurements from Astrotech.

Section 2 provides an overall description of the ASO Vandenberg complex. Section 3 briefly describes the standard services provided by Astrotech to the customer during the launch campaign. Section 4 outlines the Astrotech support during typical payload processing activities. Sections 5 and 6 provide descriptions and specifications on the electrical and communications systems. Section 7 describes the cranes in the facility and Section 8 provides descriptions and specifications on the mechanical and pneumatic systems. Section 9 contains information on the Astrotech GSE available at the site. In Section 10 the propellant and gas support is described. Sections 11, 12, 13 and 14 provide detailed information on all of the facilities to include dimensional data and all user interfaces (mechanical, electrical, communications, etc.). Appendix A provides information on the redundant Radio Frequency (RF) communications systems.

Questions pertaining to the material presented in this Manual or to mission unique requirements, which are not covered herein, should be directed to:


Senior Manager ASO VAFB
Astrotech Space Operations, Inc.
P.O. Box 5097
Vandenberg AFB, CA 93437
Phone: (805) 875-6401
Fax: (805) 734-2551


Prospective customers wishing to make arrangements for processing services at Astrotech Vandenberg or those having business related questions should contact:


Vice President and General Manager
Astrotech Space Operations, Inc.
1515 Chaffee Dr.
Titusville, FL 32780
Phone: (321) 268-3830, ext. 4004
Fax: (321) 268-3834

## 1.2 DEFINITIONS

**Accident/Incident** - unplanned event which results in personnel injury or fatality; damage to or loss of Astrotech property, public property, or private property; or could result in an unsafe situation or operational mode. An accident refers to a major event, whereas an incident is a minor event or episode that could lead to an accident.

**Astrotech** - Astrotech Space Operations, Inc. facility at Vandenberg AFB, California

**Buddy System** - at least two (2) persons are present in a hazardous situation so that one may give assistance to the other if an accident or incident occurs.

**Critical Weld** - weld where a single failure of any portion could result in injury to personnel or damage to property or flight hardware.

**Customer** - any organization using the Astrotech facilities. This includes launch vehicle operations teams as well as funding or sponsoring organizations for the payload/spacecraft. The term also applies to any payload contractor or any other organization commissioned to perform work on behalf of the sponsoring organization.

**Design Burst Pressure** - maximum pressure to which a component can be subjected without rupture.

**Failure** - inability of a system, subsystem, component or part to perform its required function within specified limits, under specified conditions for a specified duration.

**Fluid** - liquids or gases.

**Ground Support Equipment (GSE)** - ground equipment and systems needed to support the payload such as propellant loading units, data recording, instrumentation, etc.

**Hazard** A situation that involves a potential risk caused by an unsafe act or condition.

**Hazard Proof** - level of protection to prevent explosive atmosphere penetrating electrical fixtures where sparking or arcing could occur.

**Hazardous Fluid** - any fluid that is toxic, cryogenic, flammable, or corrosive.

**Maximum Allowable Working Pressure (MAWP)** - the maximum pressure at which a component can continuously operate based on allowable stress values and functional capabilities. MAWP is synonymous with MDOP (Maximum Design Operating Pressure) or Rated Pressure.

**Maximum Operating Pressure (MOP)** - the maximum pressure at which the system or component actually operates in a particular application. MOP is synonymous with MEOP (Maximum Expected Operating Pressure) or Maximum Working Pressure.

**Payload** - any equipment or material carried by the STS or an ELV. It includes items such as free-flying automated spacecraft, individual experiments or instruments, payload support equipment, etc. As used in this document, the term payload also includes payload-provided GSE and systems, as well as flight and ground systems software.

**Proof Pressure** - the test pressure to which all components and pressure systems are to be tested on an annual basis to ensure the integrity of that system.

**Referee Fluid** - compatible fluid, other than that used during normal operation of a system, which is substituted for test purposes because it is safer due to characteristics such as being less toxic, less explosive, easier to detect, etc.

**Requirement** - specified mandatory condition that must be complied with unless a waiver is approved by Astrotech and/or the customer.

 

**Shall** - mandatory action.

**Should** - recommended action.

**Space Transportation System (STS)** - Space Shuttle, related payload elements and the ground sites needed to support these elements.

**Waiver** - granted use or acceptance of an article that does not meet the specified requirements.

**Will** - advising of future action.

**1.3 ACRONYMS**

| | |
|---|---|
| 30 SW | 30th Space Wing |
| AC | Alternating Current |
| ACR | Auxiliary Control Room |
| AKM | Apogee Kick Motor |
| ASE | Airborne Support Equipment |
| ASHRAE | American Society of Heating, Refrigeration and Air Conditioning Engineers |
| ASO | Astrotech Space Operations, Inc. |
| CCTV | Closed Circuit Television |
| CCW | Counter-Clockwise |
| CD & SC | Communication Distribution and Switching Center |
| CG | Center of Gravity |
| C of C | Certificates of Compliance |
| COFR | Certificate of Facility Readiness |
| COMSEC | Communications Security |
| CR | Control Room |
| CW | Clockwise |
| DoD | Department of Defense |
| DOT | Department of Transportation |
| EELV | Evolved Expendable Launch Vehicle |
| EGSE | Electrical Ground Support Equipment |
| ELSA | Emergency Life Support Apparatus |
| ELV | Expendable Launch Vehicle |
| EM | Electromagnetic |
| ESD | Electro-Static Dissipative |
| EWG | Elliptical Waveguide |
| FMCS | Facility Maintenance Control System |
| FTZ | Foreign Trade Zone |
| GFE | Government Furnished Equipment |
| GORR | Ground Operations Readiness Review |
| GOWG | Ground Operations Working Group |
| GSE | Ground Support Equipment. |
| HEPA | High Efficiency Particulate Air |
| HERF | High Energy Radiographic Facility |
| HPF | Hazardous Processing Facility |
| HSF | Hazardous Storage Facility |
| HVAC | Heating, Ventilation, and Air Conditioning |
| Hz | Hertz (cycles per second) |
| ICD | Interface Control Document |
| IPA | Isopropyl Alcohol |
| IR | Infrared |
| ITAR | International Traffic in Arms Regulations |
| kW | Kilowatt |
| LAN | Local Area Network |
| LC | Launch Complex |
| L-Count | Countdown with hold time |
| MAWP | Maximum Allowable Working Pressure |
| MDOP | Maximum Design Operating Pressure |
| MEOP | Maximum Expected Operating Pressure |
| MEV | Million Electron-Volts |
| MGSE | Mechanical Ground Support Equipment |
| MOP | Maximum Operating Pressure |
| MMH | Monomethylhydrazine |
| $N_2O_4$ | Nitrogen Tetroxide |

 

| | |
| --- | --- |
| NASA | National Aeronautics and Space Administration |
| NDTL | Non-Destructive Test Laboratory |
| NFPA | National Fire Protection Association |
| OIS | Operational Intercommunication System |
| OSHA | Occupational Safety and Health Administration |
| OVS | Operational Voice System |
| PDU | Power Distribution Unit |
| POC | Point of Contact |
| PPF | Payload Processing Facility |
| PPRD | Payload Processing Requirements Document |
| RF | Radio Frequency |
| RFA | Radio Frequency Authorization |
| RLV | Reusable Launch Vehicle |
| SA-ALC | San Antonio Air Logistics Center |
| SCAPE | Self-Contained Atmospheric Protective Ensemble |
| SI | International System of Units |
| SLC | Space Launch Complex |
| SOP | Standard Operating Procedure |
| SPF | Spacecraft Processing Facility |
| STS | Space Transportation System |
| T-Count | Countdown |
| TSB | Technical Support Building |
| TSBA | Technical Support Building Annex |
| TME | Total Measuring Error |
| UPS | Uninterruptible Power Supply |
| USAF | United States Air Force |
| UTC | Universal Time Code |
| UV | Ultra Violet |
| VAFB | Vandenberg Air Force Base |
| VPF | Vertical Processing |

## 1.4 REFERENCE DOCUMENTS

Astrotech Facility Safety Plan SHI-ASO-M0011
Emergency Spill Response Manual
Emergency Preparedness and Notification Checklist
Process Safety Management, Employee Participation Policy
Environmental Management Manual SHI-ASO-M0004
Contamination Control Plan SHI-ASO-M0002

# 2. FACILITY OVERVIEW

## 2.1 LOCATION

Astrotech Vandenberg is located on Vandenberg Air Force Base. The Astrotech Space Operations Payload Processing Facility (ASO PPF) is situated at the corner of Tangair and Red Road adjacent to the Vandenberg Air Force Base runway. All roadways, parking lots, and aprons are constructed of continuously poured asphalt and contain no curbs or other significant discontinuities. The distance between the support and processing buildings is approximately 1300 feet (396.24 m) and interconnecting roadways are approximately level.

This location is not only convenient to the Vandenberg airstrip for receipt of flight hardware and associated ground support equipment (GSE), but also provides ready access to all Vandenberg Space Launch Complexes (SLCs) via the existing space shuttle tow route (see Figure 2.1-1). This Figure also indicates the relative locations of the launch complexes at VAFB that support the following launch vehicles:

**Table 2.1-1 Launch Vehicles**

| **Launch Complex** | **Launch Vehicle** |
|---|---|
| SLC-2 | Delta II |
| SLC-3 | Atlas II |
| SLC-4 (East) | Titan IV |
| SLC-4 (West) | Titan II |
| SLC-6 | Spaceport International controlled launch site for various vehicles – e.g., Athena, Minataur, etc. |
| 576-E | Taurus |
| SLC-1 (Airfield) | Pegasus |

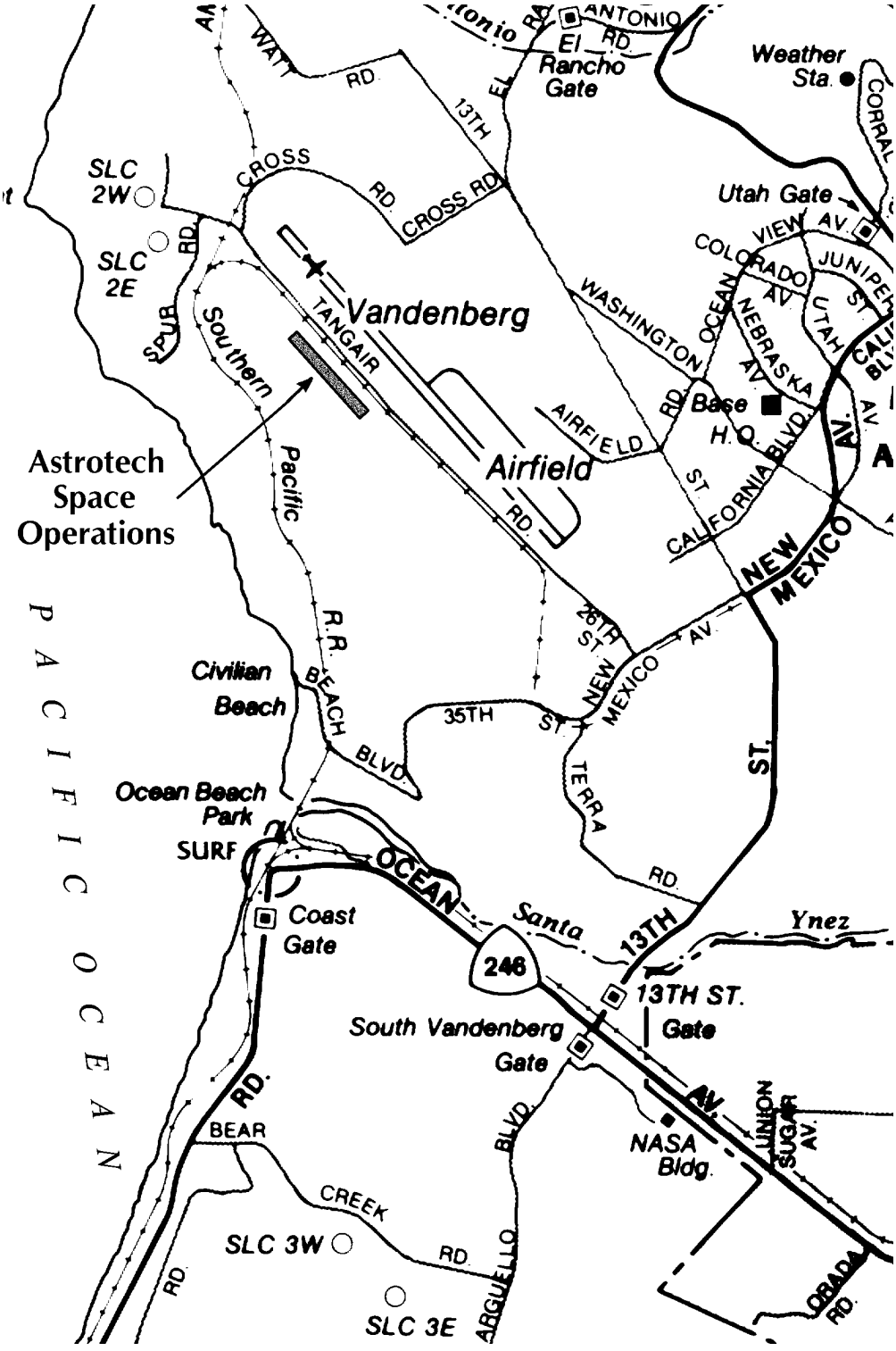


**Figure 2.1-1 Astrotech Location**

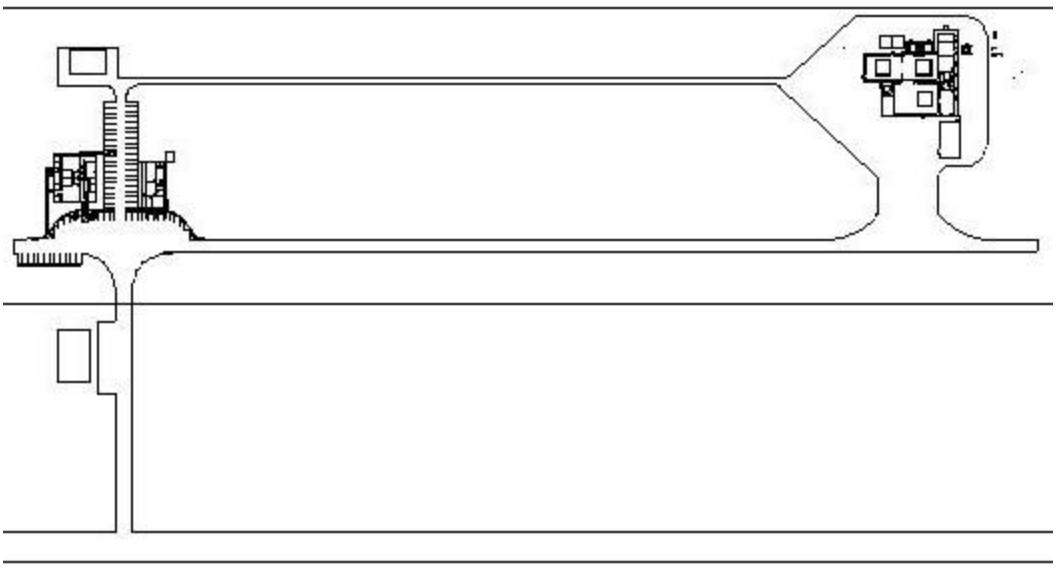

**Figure 2.1-2 Astrotech Facility Layout**

## 2.2 FOREIGN TRADE ZONE (FTZ) IMPORT LICENSES

The Astrotech Vandenberg facility is located within the Santa Maria Airport Foreign Trade Zone 237 (FTZ237). The FTZ is a secure area legally outside the customs territory of the United States but subject to all other U.S. federal laws. The operation of the FTZ allows foreign customers to import their spacecraft and GSE into the zone without payment of import duties. Astrotech obtains the necessary Temporary Import Licenses (DSP-61) required by the U.S. Department of State necessary for the import of the spacecraft and GSE. The customer is responsible for duties that are due on any goods that are permanently imported into U.S. territory, such as mission promotional material and for freight forwarding charges related to shipments imported/exported from U.S. ports located more than 50 miles from the Astrotech facility (i.e., Long Beach or Port Hueme).

## 2.3 BUILDINGS/FACILITIES

The Astrotech Vandenberg facility contains four (4) major buildings, identified as Buildings 1030, 1032, 1034, and 1036 (see Figure 2.3-2).

**Figure 2.3-1 Building 1030 – Technical Support Building Annex**

Building 1030 (see Figure 2.3-1), the Technical Support Building Annex, is located in the non-hazardous work area of the complex. It is intended to provide additional private office and conference room space for resident customer personnel independent from the spacecraft contractor teams. The building contains 4 separate offices, one (1) small conference room, a reception area, and a kitchenette.

**Figure 2.3-2 Building 1032 – Payload Processing Facility**

Building 1032 (see Figure 2.3-2), also referred to as the Payload Processing Facility (PPF), is used for all payload preparation operations, including liquid propellant transfer, solid rocket motor and ordnance installations, spacecraft/upper stage mating, and payload fairing encapsulation for certain launch vehicles. The PPF contains six clean rooms. Rooms 106 (West high bay) and 117 (East high bay) are the payload processing clean rooms room, room 109 (airlock), and rooms 107, 108, (west low bays) and 118 (east low bay) are low bays that can support a wide variety of user operations. The ground floor level of Building 1032 is 96 feet (29.26 m) above mean seal level.

**Figure 2.3-3 Building 1034- Warehouse Storage Facility**

Building 1034 (see Figure 2.3-3), the Warehouse Storage Facility, is used for short and long-term storage of equipment to include shipping containers, mechanical GSE and other items that do not require environmental conditioning. This building is located in the non-hazardous work area and consists of a single large enclosed storage area with an office and shop area.

**Figure 2.3-4 Building 1036 – Technical Support Building**

Building 1036 (see Figure 2.3-4) is located in the non-hazardous work area of the complex. It is intended to provide private office and conference room space for resident customer personnel. The building contains 14 separate offices, a conference room, reception area, private coffee bars, and a break room.

## 2.4 ELECTRICAL POWER

Vandenberg Air Force Base supplies incoming commercial electrical power to ASO Vandenberg through a series of step-down transformers. Astrotech supplies the following two (2) classes of electrical AC power for customer use:

- *60 Hz Facility Power*

This is non-conditioned power, there is no voltage regulation, or frequency control. Backup power is provided by a 250 kwa diesel generator.

- *60 Hz Technical Power*

This is conditioned power via an Uninterruptible Power Supply (UPS) with battery backup established for critical and/or sensitive loads.

## 2.5 GROUNDING

The Astrotech grounding system has three (3) components. One (1) segment is related to lightning protection and the other two (2) are power ground systems, identified as Technical Ground and Equipment Ground.

## 2.6 COMMUNICATIONS SYSTEMS

The Astrotech phone system features call-forwarding and voice mail. Handsets are available throughout the facility; additional lines can be provided for dedicated faxes.

An advanced audio digital matrix (DICES III) switch system is utilized to establish voice communications nets. A secure (monitored only by authorized users) net can be configured between any of the supported locations.

The following time/countdown signals are displayed on clocks units that are permanently mounted in each PPF control room: UTC (universal time code), L-Count (countdown with hold time), and T-Count (countdown). All PPF control rooms can simultaneously display all two (2) signals.

A public address and warning system is in place via the phone system and OVS. Speakers are distributed through out the facility.

A Closed Circuit Television (CCTV) System is in operation in the hazardous working areas. The signals can be relayed to Buildings 1030 and 1036 for customer observation of the operations. The signals are patched by Astrotech personnel in accordance with ITAR and other security requirements.

The existing Astrotech communications system to/from VAFB consists of a fiber optic communications system. The Air Force communications squadron provides an OC-3 Sonnet at the PPF to distribute T1 signals to various buildings on and off Vandenberg.

Singlemode fiber between Buildings 1032 and 1036 is installed.

## 2.7 ENVIRONMENTAL CONTROL

The environmental control system requirements for ASO Vandenberg exceed the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) design requirements for the Vandenberg Area. All clean work areas are designed and operated to meet the requirements of Federal Standard 209 Class 100,000 (SI M6.5) (0.5 micron) cleanliness. Improved cleanliness standards are available to the customer on a mission-peculiar basis.

 

## 2.8 SECURITY

ASO Vandenberg is a Department of Defense (DoD) cleared facility with an active Communications Security (COMSEC) account. The high bays, air locks and control rooms have been designed to provide security levels that comply with the DoD Industrial Security Manual. Safeguarding capability also exists. Processing classified payloads at ASO Vandenberg can be accomplished in the approved closed areas in Building 1032. The regulations of the Defense Industrial Security Program and the National Security Agency govern the management of such activities.

The ASO Vandenberg complex is surrounded by a six (6) foot (1.83 m) high chain-link perimeter fence that is topped with three (3) strands of barbed wire. Access is controlled by a single gate on Red Road. The gate has a 30 foot (9.144 m) wide opening with no overhead obstructions. Because Astrotech VAFB is located on Vandenberg AFB, access is strictly controlled and patrolled on a regular basis.

The high bay complexes are compartmentalized by design to allow complete segregation between multiple programs resident on-site. Individual cipher locks and locking hasps are provided on all internal and external doors leading into the various payload processing areas. Configuration of the facility locks is controlled by ASO security in liaison with the customer. Astrotech fully complies with the requirements of ITAR and works with the customer to ensure compliance.

## 2.9 LIQUID PROPELLANT AND ORDNANCE STORAGE

All liquid propellants and Category A ordnance items to be used during mission processing operations at ASO Vandenberg must be shipped directly to the Vandenberg Hazardous Storage Facility. ASO Vandenberg does not have a storage facility for these items. ASO will coordinate all arrangements for the use of these government facilities. Category B and C ordnance items may be shipped directly to the ASO Vandenberg facility. Astrotech provides approved storage cabinets for such ordnance items. Astrotech is not a liquid propellant storage facility, customers propellants are staged at Astrotech for the minimum duration commensurate with thermal conditioning and propellant loading operations.

## 2.10 SITE SURVEY OF ASTROTECH PROPERTY

A survey of the site at Astrotech Vandenberg was conducted to establish datum points for true North.

**Table 2.10-1 Site Survey Details**

| Station | Latitude Degree-Minutes-Seconds | Longitude Degrees-Minutes-Seconds |
|---|---|---|
| Bldg 1030 | | |
| Bldg 1032 | $34^{o}$ 44.49 N | $120^{o}$ 36.01W |
| Bldg 1034 | | |
| Bldg 1036 | | |

## 2.11 WEATHER

Weather is an important factor for operations at Astrotech. All weather is tracked via the Vandenberg Weather Squadron and is relayed to Astrotech via the Vandenberg AFB Command Post.

 

# 3 ASTROTECH SERVICES

## 3.1 STANDARD SERVICES

Astrotech provides the facilities and standard services required to support the processing of the customer payload. A detailed listing is provided below:

1. - Astrotech provides use of the appropriate facility space as mandated by the processing requirements for the particular mission. Maximum mission occupancy periods are as specified in the applicable launch services contract.

a. Payload Processing Facility (Building 1032) - use of one (1) High Bay Complex for hazardous and non-hazardous processing operations consisting of the High Bay, the associated Garment Change Room, Control Room, and one (1) contiguous Office Area (minimum 985 ft 2 (91.51 m 2)).

b. Warehouse Storage (Building 1034) - storage of flight hardware and GSE will be provided in the Astrotech warehouse facility. Non-conditioned storage is available. Warehouse accommodations are provided on a shared-use basis.

c. Customer Office Accommodations (Building 1036) - use of offices and shared-use of conference rooms and reception areas. Additional overflow space is available in Building 1030 the Technical Support Building Annex if required.

2. Arrival and Departure Transportation - Astrotech provides for transportation of crated flight hardware and associated GSE by commercially available ground transportation vehicles from and to terminals within a 50-mile radius of Astrotech. This service will accommodate shipment by air to/from commercial or Government airports in the vicinity of the Astrotech Vandenberg facility. Astrotech will make provisions for standard flight line support equipment.

3. Local Transportation - by means of commercially available ground transportation vehicles, Astrotech provides transportation and delivery of the crated Payload or Payload elements, and GSE, within the Astrotech Facility, and to/from the Astrotech Vandenberg facility and designated facilities at VAFB.

4. Ordnance Handling and Storage - Astrotech will arrange for receiving, inspection, and storage of ordnance items; bridge-wire checks; and cold soak and x-ray of solid rocket motors.

5. Communications - Astrotech provides data circuits and voice communications between Building 1032 and VAFB, between Building 1032 and Building 1036, and between Building 1032 and Building 1030, in addition, CCTV is provided in and between Building 1036, Building 1032 and Building 1030. Astrotech will provide on-site Local Area Network (LAN) connectivity, local telephone service, and a dedicated facsimile machine for customer use.

6. Electrical Power - Astrotech provides 60Hz electrical power, both technical and utility grade, for spacecraft GSE.

7. U.S. Government Coordination - Astrotech provides all necessary coordination with the U.S. Government [NASA and United States Air Force (USAF)] for any required mission support services provided by the U.S. Government or its contractors.

8. Solvents and Gases - Astrotech provides moderate quantities of gaseous nitrogen (MIL-PRF- 27401, Type 1, Grade B), liquid nitrogen in 180 liter dewars (MIL-PRF-27401, Type 1, Grade B), gaseous helium (MIL-PRF-27407,Type 1, Grade A), isopropyl alcohol (TT-I-735), demineralized water (JSC SPEC-C-20), and other general purpose cleaning agents and solvents. (Reference Sections 10.3 and 10.4.) The quantities are defined to Astrotech in the PPRD or ICD.

9. Hazardous Waste Disposal - Astrotech provides for disposal of hazardous materials, such as propellants and solvents, generated during the Customer's payload processing activities. Astrotech's EPA ID Number is CAL000206369.

10. Sampling and Analysis - Astrotech provides for sampling and analysis of up to five (5) samples of gases, propellants, and solvents.

11. Photographic Services - Astrotech provides photographic and video graphic support of customer operations through the use of the 30 Communications Squadron. Requests will be submitted for video, 35 mm, or still picture support.

12. Emergency Medical and Fire Protection - Astrotech provides emergency medical assistance and fire protection utilizing the services of Vandenberg Air Force Base, the City of Lompoc, and Santa Barbara County, respectively.

13. Equipment Calibration - Astrotech provides standard equipment calibration services for up to five (5) items of the customer's support equipment.

14. Clean Room garments - Astrotech provides IEST-RP-C006 tested clean room suits, shoe, beard, and head covers for customer use.

15. Personnel Protective Suits - Astrotech provides self-contained, air hose-type personnel protective suits, and related training and support for the customer's team to support propellant handling, transfer, and loading operations. Astrotech will arrange for attendance at available related NASA training courses, if requested.

16. U.S. Customs Clearance - Astrotech arranges for duty-free entry of the payload and any payload processing materials and equipment entering the U.S. from another country for the duration of the Occupancy Period. Astrotech Vandenberg is located within a noncontiguous portion of the Santa Maria Airport Foreign Trade Zone (FTZ No. 237).

19. Foreign Import Documentation - Astrotech obtains the necessary U.S. Government licenses to support the import of the payload and related GSE for missions involving spacecraft manufacturers located outside the United States.

### 3.2 OPTIONAL SERVICES

Astrotech provides additional services for the customer on an as-requested basis. Optional services are provided on a cost plus fee basis. Some frequently provided additional services include:

1. Propellant procurement
2. Freight forwarding
3. Spacecraft propellant loading
4. Long distance telephone service
5. Administrative staff
6. Non-facility related janitorial service
7. Precision cleaning
8. Packing and shipping.

 

# 4 CUSTOMER OPERATIONS AT ASTROTECH

## 4.1 DOCUMENTATION

### 4.1.1 Payload Processing Requirements Document / Interface Control Document

Per the terms of the contractual agreements between Astrotech and its customers, a Payload Processing Requirements Document (PPRD), Interface Control Document (ICD), or equivalent must be submitted for each payload to be processed at Astrotech. The purpose of the PPRD or ICD is to outline all planned payload processing activities and describe in detail all mission requirements to be supplied by Astrotech, to include facilities, equipment, materials, and services.

It is intended that the support items documented in the PPRD/ICD be a compilation of requirements discussed and agreed to during the Ground Operations Working Group (GOWG) process. Once signed, the PPRD/ICD constitutes the support baseline for the mission. The completed PPRD/ICD is required 60 days prior to the start of the launch campaign.

### 4.1.2 Spacecraft Test Procedures

Astrotech will conduct a mandatory safety review of the spacecraft customer operating procedures, with particular emphasis on the hazardous operations. These will be checked for safe working practices and conformance with the Astrotech Facility Safety Manual SHI-ASO-M011. These procedures shall be submitted to Astrotech for review no later than 60 days prior to the start of the launch campaign.

## 4.2 TYPICAL PAYLOAD PROCESSING SEQUENCE

A typical Astrotech processing flow is depicted in Figures 4.2-1 and 4.2-2.

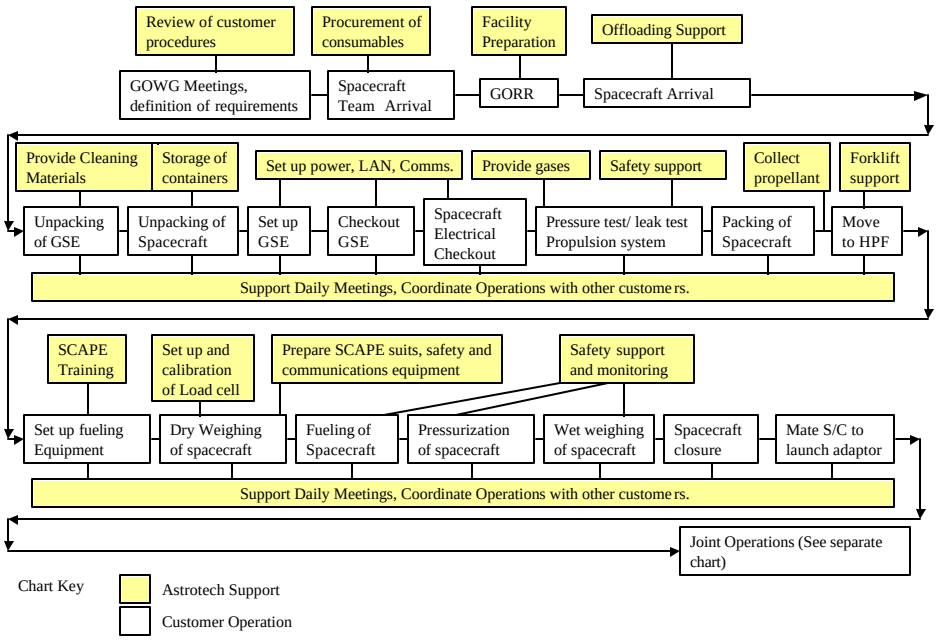


**Figure 4.2-1 Astrotech Spacecraft Preparation Support Flow**

 

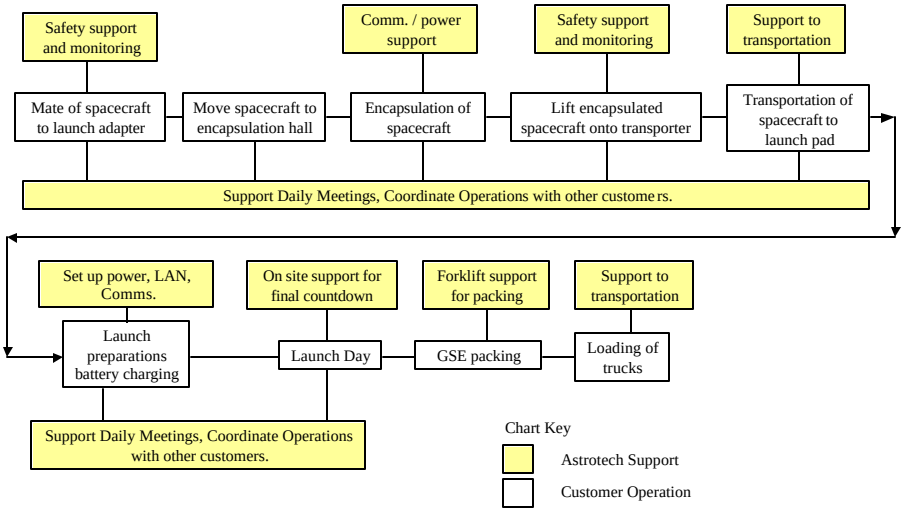


**Figure 4.2-2 Astrotech Joint Operations Support Flow**

### 4.2.1 Planning Meetings

A series of GOWGs meetings are held between the customer, launch service provider, and Astrotech personnel prior to the commencement of the launch campaign. At these meetings the customer's requirements are defined and detailed to ensure that the final PPRD/ICD is complete and supportable. The Ground Operations Readiness Review (GORR) is held the day before the arrival of the spacecraft.

At this meeting, the launch vehicle team and Astrotech personnel present the readiness of the facilities and launch vehicle to start the launch campaign. A planning and coordination meeting is held daily on duty days following the GORR through launch.

### 4.2.2 Facility Preparations

Prior to arrival at ASO, the facility is prepared for the customer in accordance with the provisions of the PPRD/ICD. The relevant processing complex is cleaned to the required level and the environmental parameters are set and verified. A particle counter is set up in the high bay to monitor the cleanliness levels. The printout of the cleanliness, temperature and humidity is collected for a period of three (3) days prior to arrival and is presented to the customer upon arrival at the facility.

The communications and electrical power interfaces are configured to the requirements; mechanical systems, and other support elements are checked and made ready for use. Consumables are procured to ensure the spacecraft teams can begin processing immediately.

At the earliest opportunity, the customers are provided with a facility familiarization class that outlines the safety and emergency procedures. A safety walk-down of the hazardous work facilities is required for personnel who will be working in these areas. Where appropriate, customer personnel are provided with crane and forklift familiarization. All personnel working at Astrotech are issued facility access cards once their familiarization is completed.

 

### 4.2.3 Spacecraft Arrival

Payload processing activities typically begin with the arrival of personnel and/or mission equipment at ASO. If equipment delivery to the launch site is by aircraft, ASO will provide local transportation of all items from any terminal within a 50-mile (80 km) radius of the facility. Standard loading and unloading equipment, such as forklifts, mobile cranes and aircraft loaders, will be provided by ASO. Specialized loading and unloading equipment, such as peculiar slings or dollies, are the responsibility of the customer.

ASO coordinates the required support with the applicable landing facility. The trucks required for the offloading and transportation are ordered and arranged by ASO to meet customer requirements. It is standard practice for the spacecraft to be transported on an air ride truck. GSE is transported on flat bed trucks. Customer's packaging designs should allow for easy offloading from aircraft and onto enclosed van trucks (if required) using forklifts and pallet jacks.

ASO personnel accompany the convoy and ensure that it is delivered safely to the facility. The transportation time from the VAFB airfield to ASO is approximately 30 minutes at convoy speed. ASO and Security coordinate the movement of the convoy to ensure that there are no delays in the movement of the trucks.

Upon arrival of the convoy vehicles at ASO, the payload and its GSE are moved to the appropriate areas of the facility by ASO personnel under the supervision of the payload contractor. Payload contractor personnel are responsible for all container cleaning, uncrating, receiving inspection, and installation of all test equipment and flight hardware. ASO will provide cleaning materials for the spacecraft and equipment containers as required.

### 4.2.4 Spacecraft Standalone Operations

At the start of this phase of the launch campaign, ASO will closely support the customer as the equipment is set up and connected to the various facilities interfaces. Assistance is given to establish the required communications links and LANs for the customer. End item instruments such as hubs are customer provided. If the customer has arranged for a T1 line from an outside provider for connectivity to their home facilities, ASO will ensure it is properly connected to the customer's control room. The customer is responsible for verifying the connectivity of the T1 line from the Astrotech facility back to their own facility. Empty equipment containers are moved to on-site storage areas as appropriate.

Once set up and validation of the GSE is completed, the payload contractor will typically begin spacecraft final assembly and test operations. These tests and operations are defined by the customer and include electrical checkout of the payload and other systems, propellant tank pressure demonstration, partial pressurization of the high-pressure tanks, and Category B ordnance installation. ASO will provide daily support to the customer during this period as required.

Upon completion of PPF activities, the payload will be prepared for hazardous operations. The spacecraft customer or launch services provider is responsible for providing all interfaces between the facilities. In this case it is normal practice for the spacecraft propulsion team to begin equipment set-up in the fueling island in parallel with the electrical testing. The required gases and equipment are provided as required.

Astrotech will monitor the processing complex to ensure that the environment is being maintained to the customer's requirements and to verify the spacecraft processing activities are compliant with the ASO Facility Safety Manual SHI-ASO-M0011.

### 4.2.5 Spacecraft Hazardous Operations

In preparation for this phase of the operation, Astrotech personnel work closely with the spacecraft propulsion team to ensure that their test configuration is safe, including the positioning of the GSE to ensure adequate clearances for the Self-Contained Atmospheric Protective Ensemble (SCAPE) team. SCAPE suit sizing, fitting, and familiarization are normally conducted prior to the arrival of the spacecraft in the PPF. Astrotech will also arrange for the timely delivery of the propellant from the HSF to ASO in time to allow for adequate thermal conditioning.

 

ASO supports the movement of the spacecraft into the PPF and ensures that the facility is clean once the transport container has been positioned in the building and prior to removal of the spacecraft from the container. The spacecraft is lifted from its container onto the fueling stand or handling device where it is prepared for the fueling operations and final pressurization as necessary.

During the hazardous operations, the Astrotech Safety Officer coordinates the support of medical personnel and emergency first responders. The Astrotech Safety Officer approves all hazardous and non hazardous procedures and ensures that the facility is ready to support propellant loading operations, including the breathing air system and emergency support equipment. All dynamic hazardous operations are recorded in their entirety using the CCTV system.

This recording includes the full audio transmissions from the radio system. At the end of the fueling operations, Astrotech will assist with the clearing of the fueling island and preparation for the second propellant if required. The area is then opened for normal operations.

Once propellant is present in the building, additional safety requirements are necessary. ASO will monitor all tasks in the PPF closely during this time and will ensure the area is cleared for work each day with a daily morning walk-down procedure that includes monitoring for potential propellant leakage.

After completion of the fueling operations, the customer completes the thermal blanket installation, final closeouts on the spacecraft, and, if required, performs the final weighing. Astrotech supports the weighing operations, which are considered hazardous due to the lifting of the fueled spacecraft. After completion of the fueling operations, any Category A ordnance is installed, as required, in the PPF.

At the end of this hazardous processing the spacecraft is ready for the start of the joint operations phase.

In parallel with the spacecraft processing operations, the fairing (and third stage, if required) preparations are performed. Astrotech coordinates customer activities to ensure that the operations of both teams are completed with minimum disruption.

Certain hazardous operations in Building 1032 require the closure of the building for all other operations during the spacecraft processing. Building 1032 facility is designed to allow parallel hazardous operations in adjacent bays. The Astrotech Facility Safety Manual SHI-ASO-M0011 details the criteria for building closure.

### 4.2.6 Joint Operations with the Launch Service Provider

Joint operations are conducted in the PPF (Building 1032) and begin with the mating of the spacecraft to the launch vehicle adapter. This is a hazardous lift and Astrotech coordinates with both teams and monitors the number of personnel in the area, and for recording the operation. Once complete, the spacecraft/adapter assembly is moved for the encapsulation and lifting of the composite onto the transporter. The transportation of the payload and fairing are normally conducted during off hours for thermal benefits, and to minimize the difficulties with traffic and the unpredictable Vandenberg weather. Astrotech provides support to the launch vehicle team as required.

### 4.2.7 Launch Pad Operations

Astrotech will provide transportation, using the Astrotech truck, for the customer's launch pad GSE to the blockhouse at the respective launch site. Astrotech personnel provide support to the customer through launch day and will provide trouble-shooting support on the signals between the control room and the launch site.

### 4.2.8 Post-Launch Operations

Once the spacecraft has been launched, Astrotech provides forklift support to relocate GSE and containers for packing. This activity includes the collection and return of the GSE from the launch site. Customers are responsible for the packaging of their equipment and for the provision of packaging materials. All items are to be removed from

 

the facility at the end of the campaign, and a facility walk-down will be performed by the customer and Astrotech to ensure that the occupied areas are clear.

# 5 ELECTRICAL POWER & GROUNDING SYSTEM DESCRIPTIONS

Primary power for the spacecraft and GSE are isolated from other power systems to reduce surges caused by transients from facility equipment, such as electric motors. The PPF provides separate power line surge protection against destructive anomalies caused by load variations on utility mains, lightning, etc.

## 5.1 ALTERNATING CURRENT (AC) POWER

Astrotech maintains and supplies two (2) classes of electrical Alternating Current (AC) power. Details are provided in the following subparagraphs:

### 5.1.1 60 Hz Facility Power

The 60 Hz facility power supply is non-conditioned power. There is no autonomous voltage regulation, frequency control, or backup provided by Astrotech equipment. All non-critical loads (60 Hz) should be connected to this class of service. Multiple receptacle types are provided as listed in Table 5.1-1 and illustrated in Figure 5.1-1. Phase rotation is clockwise X(A) - Y(B) - Z(C).

### 5.1.2 60 Hz Technical (UPS) Power

The 60 Hz technical power supply is conditioned power via a three phase, transistorized, pulse-width modulated on-line UPS with battery backup established for critical and/or sensitive loads. All critical processing/launch system loads (60 Hz) should be connected to this class of service. Multiple receptacle types are provided as listed Table 5.1-1 and illustrated in Figure 5.1-1. Phase rotation is clockwise X(A) - Y(B) - Z(C).

Technical power is supplied consistent with the following specifications:

1. *Voltage regulation* - voltage shall be regulated to be within ± 5 percent of the specified operating level from no load to full load, with a power factor ranging from unity to 80 percent lagging.

2. *Frequency regulation* - frequency shall be regulated to be 60±1 Hz.

3. *Harmonic content* - harmonic content shall not exceed 6 percent rms, total.

4. *Transients* - transient amplitude shall not exceed 100 percent of the maximum line voltage amplitude with maximum duration of 200 microseconds.

5. Battery backup capacity is 10 Minutes at 90% of rated kVA. This power supply is not used for the blowers, motors, or pumps.

**Table 5.1-1 Receptacle Types - 60 Hz**

| Description | Facility Connector Type | User Connector Type |
|---|---|---|
| 125/15A/1ϕ | NEMA 5-15R | NEMA 5-15P |
| 125/20A/1ϕ | NEMA 5-20R | NEMA 5-20P |
| 125/30A/1ϕ | NEMA L5-30R | NEMA L5-30P |
| 120-208V/60A/3ϕ | NEMA 14-60R | NEMA 14-60P |
| 120-208V/60A/3ϕ | NEMA 18-60R | NEMA 18-60P |
| 125-208V/30A/3ϕ | NEMA L21-30R | NEMA L21-30P |
| 277-480V/30A/3ϕ | NEMA L16-30R | NEMA L16-30P |
| 125V/20A/1ϕ (Explosion Proof) | Appleton EFS175-2023 Model B | Appleton ECP 2023 Model C |
| 120-208V/60A/3ϕ (Explosion Proof) | Crouse Hinds BHRE6584NW | Crouse Hinds BHP6584 |
| 277-480V/30A/3ϕ (Explosion Proof) | Crouse Hinds BHRE3583 NW | Crouse Hinds BHP3583 |
| 277-480V/100A3ϕ (Explosion Proof) | Crouse Hinds BHRC0486 D | Crouse Hinds BHP0486 |

 

| 277-480V/60A/3ϕ (Explosion Proof) | Crouse Hinds BHRE 6584NW | Crouse Hinds BHRP6584 |
|---|---|---|

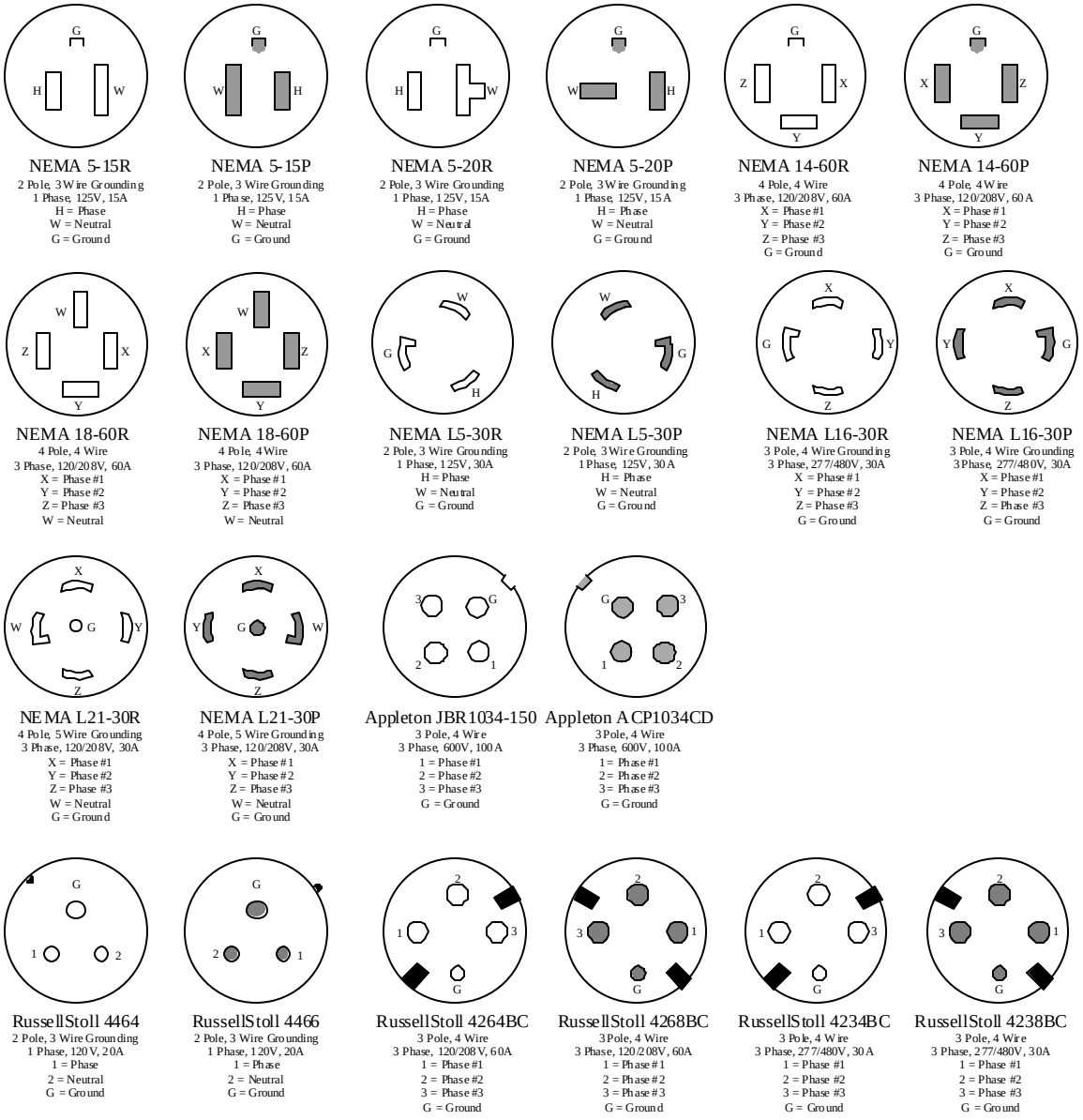


**Figure 5.1-1 Receptacle Configuration – 60 Hz**

### 5.1.3 Standby Power

A 250 kW standby power generator is used as an auxiliary power source for the PPF in the event of a VAFB power outage. Standby power is transferred automatically and supplies power to the PPF within eight seconds of a power outage.

A 120 kW standby power generator is used as an auxiliary power source for the Technical Support Building or Auxiliary Control Room. Standby power is transferred manually.

### 5.1.4 Power Distribution Units (PDU)

 

Five (5) Power Distribution Units are available (Figure 5.1-1) to provide addition, non-explosion proof outlets if required. The PDU offers various 110 vac and 208 vac power sources receptacles to meet customer requirements.

**Figure 5.1-1 – Power Distribution Unit**

### 5.1.5 Facility Lighting

Primary high bay lighting is via explosion proof 400/100 watt High Intensity Discharge lamps positioned at the 15-foot and 30-foot levels along the high bay perimeter. Table 5.1-1 details the intensity levels of the floor lighting.

**Table 5.1-1 - Lighting Intensity Levels**

| Location | Floor level | 20-foot level |
|---|---|---|
| Airlock | 80 – 90 foot-candles | 90 – 110 foot-candles |
| West High Bay | 80 – 90 foot-candles | 90 – 110 foot-candles |
| East High Bay | 90 – 100 foot-candles | 90 – 110 foot-candles |

## 5.2 GROUNDING

Astrotech has a grounding system consisting of three (3) segments. One (1) segment is related to lightning protection and the other two (2) are power ground systems identified as Technical Ground and Equipment Ground.

### 5.2.1 Lightning Protection System Grounding

The Lightning Protection System encompasses the processing facility at the highest elevations.

The protection for Building 1032 consists of 24-inch air terminals (5/8 diameter, nickel tipped), cable fasteners, and #0000 lightning protection cable. It is routed around the periphery, down the centerlines of structural sections, etc., such that typical spacing between air terminals is approximately 20 feet.

There is a minimum of ten (10) down conductors (#0000) which connect directly into the earth ground grid.

### 5.2.2 Technical Grounds

The technical ground is intended as a common reference point for the spacecraft and the electrical GSE with which it interfaces. As required by MIL-STD-1542, the technical ground system is completely isolated from other grounds, except at the Single Point Ground (SPG), which then connects directly into the facility equipment ground grid.

### 5.2.2 Equipment Grounds

Equipment grounds are used for building structures, metallic cases of equipment, and power component grounds (transformers, etc.). The lightning system down conductors are also connected to equipment ground.

## 5.2 ELECTROMAGNETIC SURVEY

A comprehensive Electromagnetic (EM) Survey was performed by the Radio Frequency Measurements Laboratory Field Test Branch of ITT Federal Services Corporation. The test provided an EM survey of the 20 MHz to 10 GHz frequency range and determined the effective building EM shielding over a wide frequency range utilizing the Vandenberg AFB high power emitters as a RF source. A detailed test report may be obtained from Astrotech if required.

 

# 6 COMMUNICATIONS SYSTEM DESCRIPTIONS

## 6.1 TELEPHONE/VOICE MAIL SYSTEM

Astrotech's communications systems are compatible with other systems in use or being installed on Vandenberg AFB to support Government and commercial users. The systems all include appropriate levels of subsystem and configuration redundancy to eliminate single point failures on critical voice and data circuits. Astrotech has the experience and necessary contacts with 30 SW elements to facilitate coordination, ensuring no adverse impacts on payload processing or launch schedules.

Telephone handsets are provided throughout all of the ASO offices and work areas. The internal phone system is the full service NEC IVS 2000, which includes call forwarding, voice mail, and a additional line will be provided to both the spacecraft contractor and the customer for dedicated fax service.

Two types of telephone units (digital or analog) are provided. Each digital telephone unit is capable of speed dialing and speakerphone operation.

Each user has the option of activating a personal voice mailbox. Mailboxes have notification parameters that the users may modify and change to their personal needs.

## 6.2 VOICE COMMUNICATIONS SYSTEM

An advanced audio digital matrix switch system (DICES III) is utilized to establish voice communication nets. A secure (monitored only by authorized users) net can be configured between any of the Astrotech locations listed in Table 6.2-1.

**Table 6.2-1 Voice Communication System Configurations**

| Building | Area | Keypanel Stations |
|---|---|---|
| 1032 | West Control Room | 2 |
| 1032 | West High Bay | 4 |
| 1032 | West Low Bay | 1 |
| 1032 | East Control Room | 4 |
| 1032 | East High Bay | 4 |
| 1032 | East Low Bay | 1 |
| 1032 | Auxiliary Control Room | 5 |
| 1036 | Conference Room | 2 |
| 1030 | Conference Room | 0 |

The communications system is available in all control rooms and high bays. Communication with this system is via either a 30 channel station, 25 channel station, or 5 channel station. Table 6.2-1 lists the possible number of stations for each location. The units have a built-in speaker for hands free monitoring.

Astrotech maintains voice communication connectivity for up to 24 channels to the following VAFB Space Launch Complexes for launch processing support: SLC-2, SLC-3, SLC-4(East), SLC-4(West) and SLC-6.

## 6.3 TIMING/COUNTDOWN SYSTEM

The following time/countdown signals are available for display via clocks units: UTC (universal time code), L-Count (countdown with hold time), and T-Count (countdown). All PPF control rooms can simultaneously display two (2) signals via two (2) separate display clocks. Time of Year or Universal Time Codes are supplied to the user via a BNC female interface connector. The user interface for these timing signals is via the patch panel located in the ASO equipment rack.

 

Each clock is capable of reading IRIG-B, IRIG CS3, and IRIG 109-64.

## 6.4 PUBLIC ADDRESS/AURAL WARNING

A public address system is available in Buildings 1032, 1030, and 1036. Announcements can be made via the telephone system in the areas specified in Table 6.4-1. This system is used to make announcements associated with hazardous tasks being performed in the facility. Paging can also take place using the OVS. OVS pages take priority over normal pages.

**Table 6.4-1 Public Address System Locations**

| Building | Room | Speakers |
|---|---|---|
| 1032 | West Control Room | 1 |
| 1032 | West High Bay | 2 |
| 1032 | East Control Room | 1 |
| 1032 | East High Bay | 2 |
| 1032 | Auxiliary Control Room | 2 |
| 1030 | TSB Annex | 6 |
| 1036 | TSB | 18 |

## 6.5 CLOSED CIRCUIT TELEVISION (CCTV) SYSTEM

Closed circuit color television cameras/monitors are available throughout Buildings 1032 as listed in Table 6.5-1. A monitors is also located in the safety office in the Astrotech administrative area. Video from Building 1032 may be distributed to the PPF control rooms and offices as required. The distribution of the CCTV signals is performed by Astrotech personnel and will be in accordance with International Traffic in Arms Regulations (ITAR) and the customer's security requirements. Permanent monitors are mounted in the PPF control rooms and in other conference rooms as described in Table 6.5-1.

In addition to the fixed cameras specified, Astrotech has one (1) mobile camera that can be made available for hazardous operations with the concurrence of Astrotech safety.

**Table 6.5-1 CCTV Camera/Monitor Locations**

| Building | Room | Monitors | Camera |
|---|---|---|---|
| 1032 | West Control Room | 1 | 0 |
| 1032 | West High Bay | 0 | 2 Fixed |
| 1032 | Airlock | 0 | 1 Fixed |
| 1032 | East Control Room | 2 | 0 |
| 1032 | East High Bay | 0 | 2 PTZ |
| 1032 | Auxiliary Control Room | 3 | 0 |
| 1036 | West Bull Pen | 1 | 0 |
| 1036 | East Bull Pen | 1 | 0 |
| 1036 | Conference Room | 1 | 0 |
| 1036 | Break Room | 1 | 0 |
| 1036 | Safety Office | 1 | 0 |
| 1030 | Conference Room | 1 | 0 |

## 6.6 FIBER OPTIC SYSTEM NETWORK

The implementation of fiber from Building 1032 is completed.

A fiber optic communications network is utilized to carry all user-supplied signals between the applicable PPF Control Room and the Launch Complex. Singlemode fiber is utilized in all cases. 30 CS/30 RANS is responsible for the maintenance, testing, and validation of fiber links between the facility and the launch complexes.

 

## 6.7 COMPLEX CABLING

Each user location (PPF or launch complex) supports the following types of cabling interfaces for flexibility in locating customer equipment:

- Fiber Optic Singlemode (ST Connector)
- LAN RJ45 (Cat 5e 568B)

# 7. CRANES

The Astrotech facilities are equipped with overhead bridge cranes as described in Tables 7-1 and 7-2. Both cranes are certified to CAL OSHA standards and meet the stringent safety guidelines contained in CFR 1910.179, "Overhead and Gantry Cranes," for conducting potentially hazardous lift operations. Astrotech personnel provide crane familiarization for the customer's certified operators. Those Users will be designated "Authorized Crane Operators." Only authorized Crane Operators" will be allowed to operate the facility crane when the spacecraft or its GSE is moved. Astrotech will not be responsible for satisfying the medical requirements or individual crane operator certification of visiting Users who will use our cranes. The User is responsible to ensure Astrotech receives a letter from a physician or User management verifying Users are medically qualified to operate a crane.

Astrotech can schedule an outside agency to provide crane certification training to personnel who require basic crane training.

The cranes are load tested by ASO personnel to 100% of rated load capacity and the hooks are inspected and NDT tested by independent inspectors on an annual basis. A summation certificate for each crane to be utilized is provided during the GORR.

Building 1032 cranes are all equipped with RF operator's pendants and attached pendants. The west high bay crane operates in a frequency range of 71-73 MHz, and the east high bay crane operates in a frequency range of 436-439 MHz. All crane hooks are isolated from the ground; customers are responsible for taking the appropriate ESD precautions when connecting to flight hardware. Prior to executing a lift using the cranes, the customer should take note of the drum winding direction.

**Table 7-1 Crane Specifications**

| **Location – Bay, Capacity** | **Hook Height** | **Lift Speed** | | **Bridge/Trolley Speed** | |
|---|---|---|---|---|---|
| | **Max. Ft. (m)** | **Min. Ft/min (mm/min)** | **Max. Ft/min. (mm/min)** | **Min. Ft/min (mm/min)** | **Max. Ft/min. (mm/min)** |
| 1032 – West High Bay/Airlock, 10T | 35'8" (10.87) | .3 (91.44) | 13 (3962.4) | 2 (609.6) | 11.3 (344.24) |
| 1032 – East High Bay, 30T | 54'10" (16.71) | .3 (91.44) | 12 (3657.6) | 2 (609.6) | 60 (18288) |

Notes:
1. All cranes are clean room compatible with debris shields that can be installed or removed at the request of the customer.

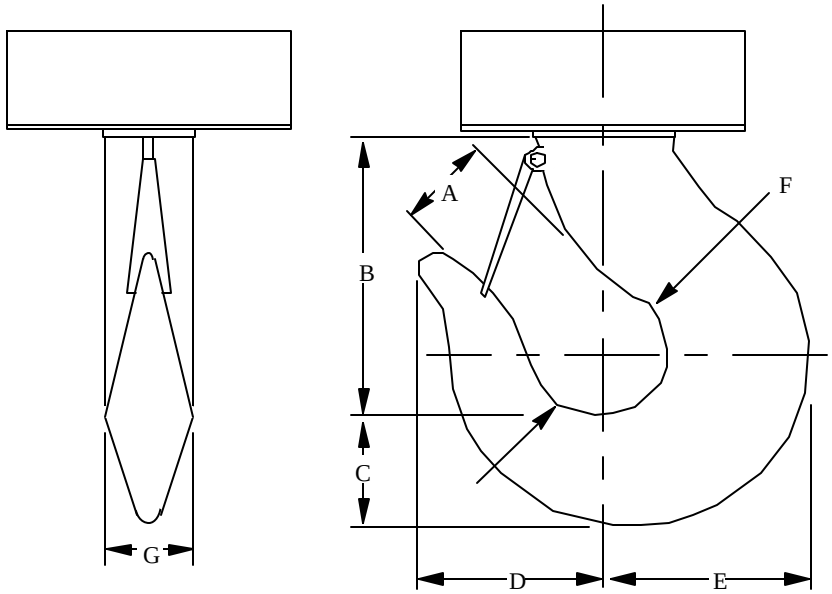


**Figure 7-1 Crane Hook Details**

**Table 7-2 Hook Dimension Details**

| **Location – Bay, Capacity** | **A** | **B** | **C** | **D** | **E** | **F** | **G** |
|---|---|---|---|---|---|---|---|
| | **In. (mm)** | **In. (mm)** | **In. (mm)** | **In. (mm)** | **In. (mm)** | **In. (mm)** | **In. (mm)** |
| 1032 – West High Bay/Airlock, 10T | 3 (76.2) | 6.75 (171.45) | 2.75 (69.85) | 4 (101.6) | 5.25 (133.35) | 3.75 (95.25) | 2.75 (69.85) |
| 1032 – East High Bay, 30T | 5 (127) | 14 (355.6) | 5 (127) | 6 (152.4) | 8 (203.2) | 6 (152.4) | 3.75 (95.25) |

## 7.1 10-TON CRANE

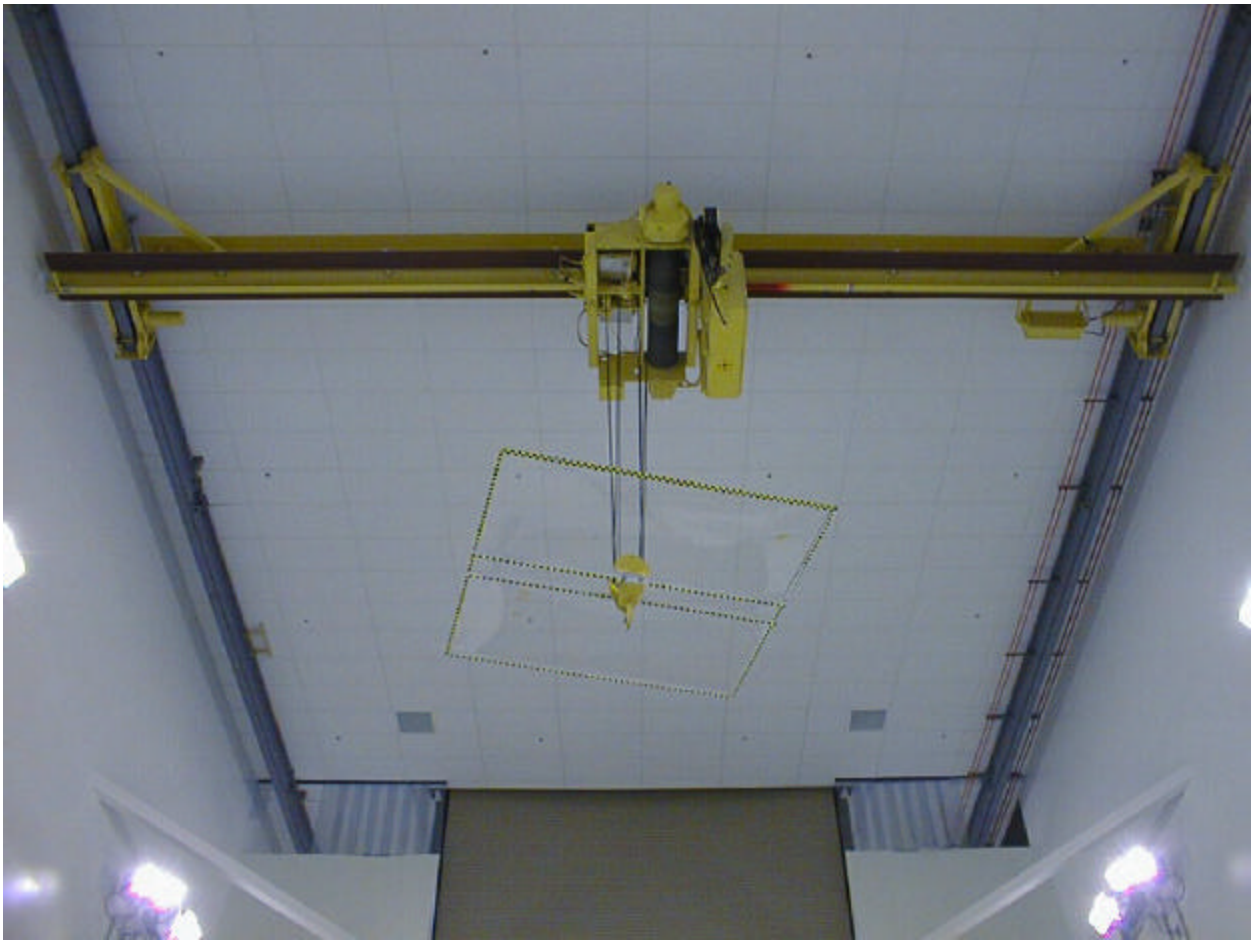

**Figure 7.1-1 10-Ton Crane**

### 7.1.1 Hoist Drive Motors

The hoist system is equipped with one (1) 10 horsepower drive motor. The motor is capable of three speeds with adjustable frequency inverter control.

### 7.1.2 Hoist Braking System

The hoist system is equipped with one (1) electro-mechanical disc type brake and one (1) mechanical load brake within the hoist gear reducer, both of which are capable of stopping and holding 100% of the full rated load of the crane. The electric brake is released by energizing a coil at the time the hoist motor is energized. Should electrical power to the motor fail, the brake will set using spring force to drive the braking plates against the friction plates. The load brake within the hoist gear reducer is of the Weston type and mounted between the first and second set of reduction gears. Upward motion of the hook disengages the brake while downward motion tightens the screw and applies the brake.

### 7.1.3 Trolley Drive Assembly

The purpose of this unit is to move the main hoist assembly laterally across the width of the bay on the bridge beam rails. This is accomplished by applying torque to the trolley drive wheels. The assembly consists of two (2), ½

 

horsepower motors. The trolley contains an electro-mechanical disc type brake used to stop and hold the trolley position and mechanical load brake. The trolley has three speeds of 50/15/2 feet per minute. The speed is controlled by an adjustable frequency inverter control, Electromotive S+ that has programmable speeds and programmable acceleration and deceleration between speed set points.

### 7.1.4 Bridge Drive Assembly

The purpose of the bridge drive system is to allow movement of the hoist system the length of the bay. This is accomplished by applying torque to the bridge drive wheels. The drive assembly consists of two (2), 1/3 horsepower motors, has three speeds controlled by an Electromotive S+ adjustable frequency inverter control, having programmable speed and programmable acceleration and deceleration between speed set points.

### 7.1.5 Crane Controls

Crane control is provided by a variable frequency hoist control (Figure 7.1.5-1), Crane Radio Transmitter). Electromotive G+, and a variable frequency bridge and trolley control, Electromotive S+. Signal to the variable frequency controllers come from the operator by two optional signal paths. The primary path is by a Telemotive radio frequency transmitter and receiver. The receiver is mounted externally to the main control panel on the hoist trolley. A parallel path to the variable frequency controllers is provided by a traditional control pendant. Both the radio frequency receiver and the control pendant exercise inputs to the controller in the form of 110 VAC presence or absence to respective control function terminals. A control relay selects which option has exclusive control.

The bridge, trolley, and hoist speed primary control is by a hand held transmitter:

- To move in micro speed, the speed position switch is toggled to low speed, a single detent push-button on the RF transmitter is engaged and motion is stopped by push-button release.

- To move in second (medium) or third (high) speed, the speed selector switch is toggled to high speed, double detent push-button is engaged to its first or second detent respectively.

Speed is switched down to medium and then to stop by releasing to the first detent and then to open. Preset acceleration and deceleration between speed levels are used for smoothness of motion.

The fixed pendant control operates identically to the radio frequency hand held transmitter except that motion in the slow (creep) speed is controlled by the first detent of a three detent switch, medium by the second detent, and fast by the third detent. When the fixed pendant is activated, control capability is removed from the remote control pendant.

Lack of a signal to the controller from either path causes a no output condition and will result in no motion of bridge, trolley, and hoist motors and all brakes being set.

The system operates on a UHF frequency from 436.0 to 439.8 MHz. The system transmits and receives serial data processed by the CPUs. A frame of serial data consists of ON/OFF bits preceded by a sync pulse with one start bit followed by eight data bits, 1 parity bit and a stop bit. System access code consists of two bytes transmitted at the beginning of each frame. The access code identifies the transmitted signal to the receiver as valid. Any received signal, which does not match the receiver access code, is considered invalid. Invalid signals rejected for lacking an access code include:

- random noise
- adjacent channel transmissions
- or a transmitter unit set to an access that does not match the receiver unit access code

 


**Figure 7.1.5-1, Crane Radio Transmitter**

Both the transmitter and the receiver have a power down feature that turns the units OFF if no commands are given within a fifteen minute period. The transmitter unit must be turned ON to enable the system.

### 7.1.6 Hoist Limit Switches

The hoist is equipped with three (3) limit switches, two geared type limit switches, one upper and one lower, and a final upper limit switch. The final upper limit switch is used in the event the other fails closed. The final limit switch will disconnect all power to the crane system by opening the main line contactor

### 7.1.7 Crane Parameters

The crane is clean room compatible with an optional debris shield that can be removed at the request of the customer.

## 7.2 30 TON CRANE

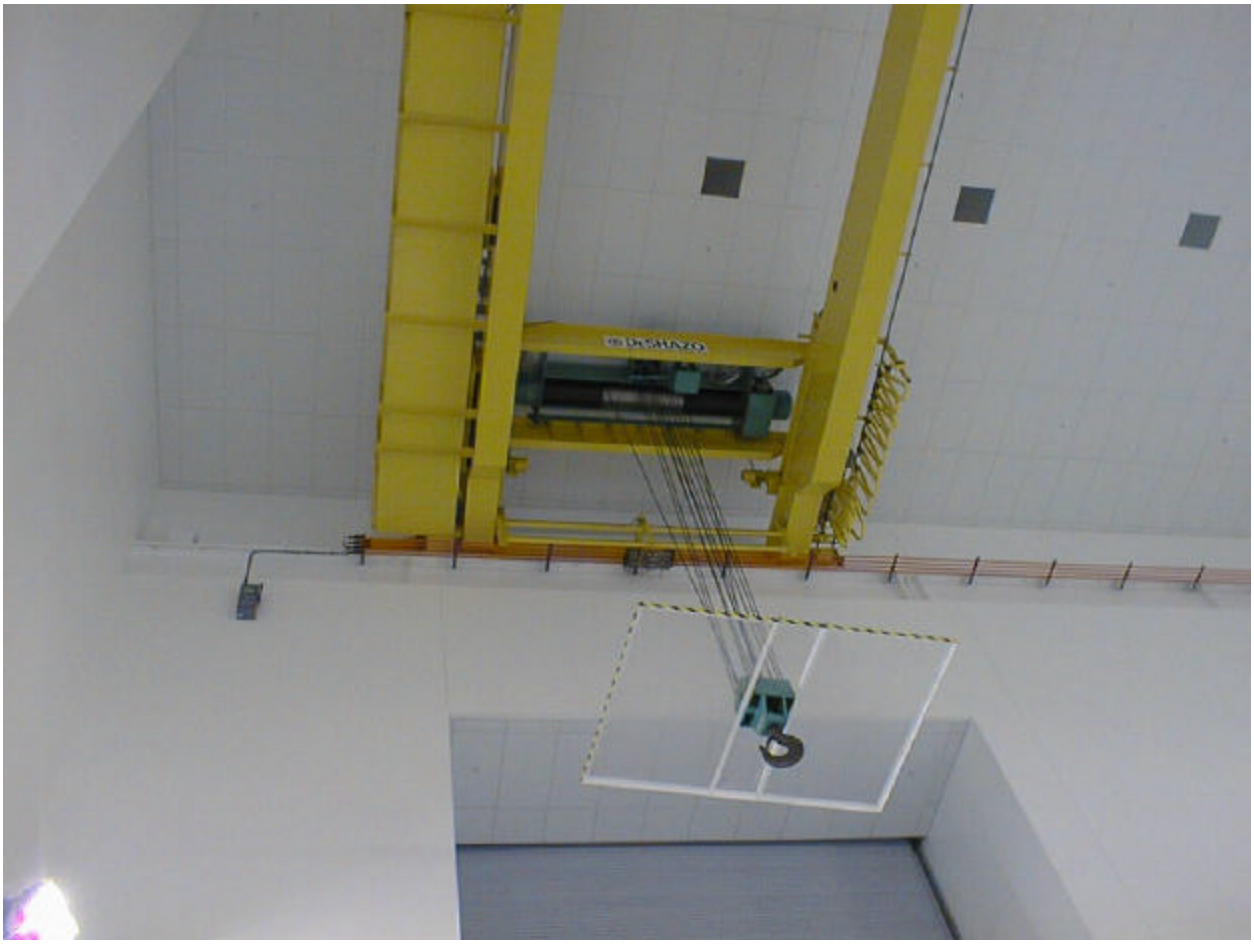


**Figure 7.2-1 – 30-Ton Crane**

Lifting operations in room 117 is performed using the 30-ton overhead crane (Figure 7.2-1). It is a top-running double girder motor driven bridge crane manufactured by DeShazo Crane. The hoist (Model P&H Hevi-Lift N-66PT 14L) is manufactured by P&H Hoist. Its purpose is to lift and position payloads/flight hardware during processing operations. The crane is composed of three major sub-systems, the hoist system, the trolley system and the bridge system. The hoist system is mounted on the trolley and allows the hoisting system to be moved the width of the bridge. The bridge system allows motion the length of the bay.

### 7.2.1 Hoist Drive Motors

The hoist system is equipped with one (1) 20 horsepower drive motor. The motor lift speeds are infinitely variable with adjustable frequency drive control with dynamic braking resistors, using P&H G+ Smartorque. Speeds are 9 FPM maximum and 0.25 FPM minimum

### 7.2.2 Hoist Braking System

The hoist system is equipped with two (2) 150% Electric Disc Motor Brakes and one (1) P&H mechanical load brake within the hoist gear reducer, both of which are capable of stopping and holding 150% of the full rated load of the crane. One of the Electric Disc Motor Brakes is mounted off the gear case and the other one off the motor with a time delay between the second brake.

### 7.2.3 Trolley Drive Assembly

The purpose of this unit is to move the main hoist assembly laterally across the width of the bay on the bridge beam rails. This is accomplished by applying torque to the trolley drive wheels. The assembly consists of two (2), 1½ horsepower motors. The trolley contains an electro-mechanical disc type brake used to stop and hold the trolley position. The trolley has infinitely variable speeds with adjustable frequency drive control with dynamic braking resistance. Maximum speed of 80 FPM and minimum speed of 2 FPM.

### 7.2.4 Bridge Drive Assembly

The purpose of the bridge drive system is to allow movement of the hoist system the length of the bay. This is accomplished by applying torque to the bridge drive wheels. The drive assembly consists of two (2), 3 horsepower motors. The trolley contains an electro-mechanical disc type brake used to stop and hold the trolley position. The bridge has infinitely variable speeds with adjustable frequency drive control with dynamic braking resistance. Maximum speed of 80 FPM and minimum speed of 2 FPM.

### 7.2.5 Crane Controls

Crane control is provided by a variable frequency hoist control. Signal to the variable frequency controllers comes from the operator by two optional signal paths. The primary path is by a Telemotive 10K radio frequency transmitter and receiver. The receiver is mounted externally to the main control panel on the hoist trolley. A parallel path to the variable frequency controllers is provided by a traditional control pendant. A control relay selects which option has exclusive control.

### 7.2.6 Hoist Limit Switches

The hoist is equipped with three (3) limit switches, two geared type limit switches, one upper and one lower, and a final upper limit switch. The final upper limit switch is used in the event the other fails closed. The final limit switch will disconnect all power to the crane system by opening the main line contactor.

### 7.2.7 Crane Parameters

The crane is clean room compatible with an optional debris shield that can be removed at the request of the customer.

30-Ton Crane Specifications

Speed

| | Micro | Fast |
|---|---|---|
| Up | 0.3 (4”) fpm | 12 fpm |
| Down | 0.3 (4”) fpm | 12 fpm |
| North | 2 fpm | 60 fpm |
| South | 2 fpm | 60 fpm |
| East | 2 fpm | 54 fpm |
| West | 2 fpm | 54 fpm |

 

# 8. FACILITY MECHANICAL AND PNEUMATIC SYSTEMS

## 8.1 COMPRESSED AIR

Regulated compressed air is available at ASO as described in Table 8.1-1.

**Table 8.1-1 Compressed Air Outlet Specifications Building**

| Location | No of Regulated Outlets | No of unregulated Outlets | Maximum Pressure | Maximum Flow rate | Interface |
|---|---|---|---|---|---|
| West High Bay | 4 | 2 | 125 psi | 100 cfm | Open |
| West Low Bay | 2 | 1 | 125 psi | 100 cfm | Open |
| East High Bay | 4 | 2 | 125 psi | 100 cfm | Open |
| East Low Bay | 2 | 1 | 125 psi | 100 cfm | Open |
| Airlock | 2 | 1 | 125 psi | 100 cfm | Open |

## 8.2 BREATHING AIR

The breathing air system in Buildings 1032 supply regulated compressed air at 125 psig (862 kN/m $^2$ ) at 100 CFM.

To achieve breathing grade air, the supply is filtered through a purification system that removes particulate, water vapor, and carbon monoxide. Downstream of the filters is an in-line remote alarm that continuously monitors for the presence of carbon monoxide. The total system will supply a volume of breathable air sufficient for four (4) people.

This is double the two-person minimum normally allowed per operation under Astrotech safety policy.

## 8.3 HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

All operational areas at Astrotech are conditioned through the use of central Humidity, Ventilation, and Air Conditioning (HVAC) systems that control the environment to the requirements of the customer.

Table 8.4-1 shows typical requirements for a program, but the ranges may be changed to suit customer requirements upon request.

**Table 8.4-1 Typical HVAC Requirements**

| Parameter | Scope |
|---|---|
| Temperature | 72 ± 5 |
| Relative Humidity | 50% ± 10% |
| Cleanliness | Class 100,000 (SI M6.5) |

All high bays and encapsulation bays are Class 100,000 (SI M6.5) work areas conforming to Fed Std 209. Each high bay HVAC unit contains high efficiency filters in the air supply ducts. These filters are capable of removing 99.97% of all airborne particulate matter over 0.3 microns in diameter. ASO uses only non-DOP tested High Efficiency Particulate Air (HEPA) filters. Each of the clean room areas has four (4) air changes per hour.

Portable particle counters with temperature and humidity probes are placed in each bay prior to occupancy to demonstrate the levels required have been achieved. Class 10,000 (SI M5) conditions can be maintained as a mission peculiar requirement through the implementation of additional cleaning and stricter controls on the customer's operations.

The temperature and humidity set points are managed by the Facility Maintenance Control System (FMCS) that is networked via a LAN to Programmable Logic Controllers. The controllers are distributed throughout the complex, and locally control and provide status of the HVAC units. This allows each bay to be set to different environmental

 

parameters and to have individual alarm limits. The FMCS output is viewed in a graphic format by Astrotech personnel who provide real-time monitoring of all systems under FMCS control. Each facility occupant can monitor the condition in the bay using a thermo-hygrograph.

The temperature and relative humidity data for all clean room areas is continuously recorded and can be archived by the central PC and is available for establishing system compliance and trending. System out-of-tolerance and alarms are reported back to the central PC. The primary system is via a remote printer connected to the FMCS. The secondary system is via the complex remote alarm system. Further, the system is enabled with remote dial-in capability, which allows remote administration and monitoring of the system after normal business hours.

## 8.4 FIRE PROTECTION

The Astrotech fire protection system is computer controlled and designed to meet National Fire Protection Association (NFPA), state, local, and base fire code requirements, as well as to provide maximum protection for spacecraft or other valuable equipment from damage due to inadvertent system activation or malfunction.

The clean room high bays and airlock in Buildings 1032 are equipped with a pre-action, dry-pipe suppression system that isolates the sprinkler heads from the water supply using a solenoid-activated valve. The piping between the valve and the sprinkler head contains low-pressure air that is continuously monitored to ensure system integrity. Two (2) events must occur before water can flow from a sprinkler head:

1. The solenoid valve must be activated by a signal from the ultra violet/infrared (UV/IR) detectors in the area, and;
2. a fusible plug on a sprinkler head must melt as a result of exposure to a high temperature heat source.

A fire signal is generated when the UV/IR sensor detects a fire. The system is immune to false alarms due to UV sources such as lighting, x-rays or arc welding or flickering IR radiation from hot objects.

Loss of pre-charge air pressure in the dry pipe system will result in a low pressure alarm only.

Each building has handheld fire extinguishers in strategic positions throughout the facility.

All areas of the PPF are equipped with ceiling mounted smoke/heat detectors with additional detectors located in the return air plenums of all air conditioning systems. A signal from any smoke/heat detector or manual pull station activates the fire alarm in that particular building. The alarm signal is transmitted to the Vandenberg AFB Fire Department.

Portable fire control equipment available throughout the complex consists of $CO^2$ and dry chemical fire extinguishers.

All buildings and work areas at Astrotech are designated as No Smoking Areas and are posted accordingly.

## 8.6 HAZARDOUS VAPOR DETECTION SYSTEM (HVDS)

Astrotech utilizes the Sentry 5000 Gas Monitoring System. It is a fixed installation gas monitoring system designed for continuous operation in open or confined areas. The system consists of a controller and eight (8) sensor modules. The sensor modules are supplied for detection of typical hazardous gases such as hydrazine, hydrogen, nitrogen tetroxide, etc. There are 2 sensors each located in the ceiling areas of the west, east, and 1 floor level sensor in the west and east low bays.

The Sentry controller is a microprocessor computer that performs functions including management of the sensor modules, management of alarm relays and interface with the user via the from panel which includes a concentration display, an alphanumeric display, keypad and status indicators. The microprocessor functions are permanently installed in the controller, they cannot be changed or damaged by the user and will not be altered by loss of power.

 

The controller continually scans all modules for alarm conditions. No sequence of key presses can prevent the scanning, except specific actions during calibration or deliberate disabling of the sensor module.

# 9. GROUND SUPPORT EQUIPMENT (GSE)

## 9.1 HYDRA-SETS

Astrotech has one (1) Hydra-Set available for customer use. The characteristics of these units are shown in Table 9.1-1. The Hydra-Set has eyebolt connections at both ends for connection to additional lifting GSE.

**Table 9.1-1 Hydra-Set Characteristics**

| Type | Rating | Stroke | Retracted Length | Extended Length |
|---|---|---|---|---|
| | Lbs. (kg) | In. (mm) | In. (mm) | In. (mm) |
| Del-Mar Avionics Model B | 5,000 (2276.962) | 6" (15.24) | 26" (66.04) | 32" (81.28) |

## 9.2 GROUND TRANSPORT VEHICLES

Astrotech has a gas power tug capable of towing 4,000 lbs.

Arrangements can be made for use of additional or different vehicles, if necessary.


**Figure 9.2-1 Astrotech Tug**

## 9.3 FORKLIFTS

Astrotech has two (2) types of forklifts available for customer support as outlined in Table 9.3-1.

**Table 9.3-1 Forklift Description**

| Forklift Type | Figure Number | Clean room Compatible | Max. Capacity lbs. (kg) |
|---|---|---|---|
| Small - Propane | 9.3.1 | No | 5,050 (2290.64) |
| Small – Electric | 9.3.2 | Yes | 3,000 (1360.77) |

The forklift dimensions, including available tine extensions, are shown in Figure 9.7-5 and Table 9.7-2. The formulas for calculating maximum allowable loads are presented in Table 9.7-3. Battery chargers for the clean room forklift is available in the air locks of Buildings 1032.

 


**Figure 9.3-1 Small Forklift (Propane)**


**Figure 9.3-2 Small Forklift (Electric)**

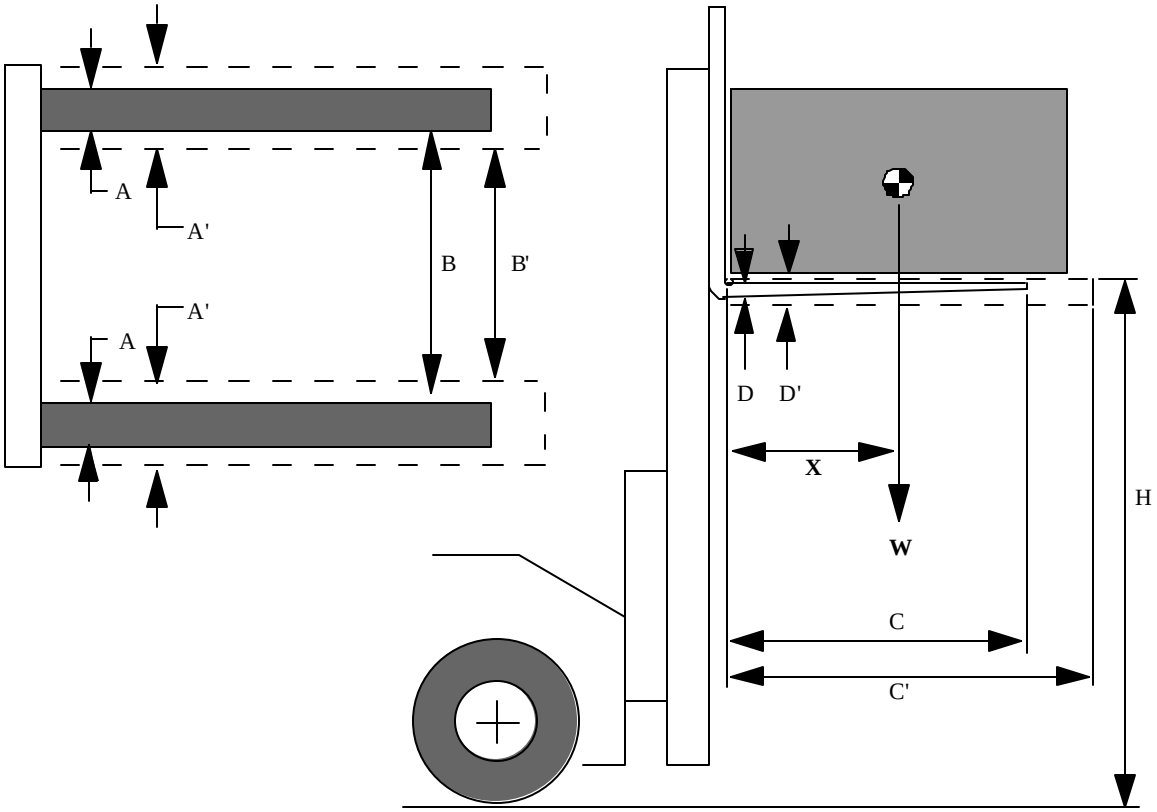


**Figure 9.3-5 Forklift Dimensions**

**Table 9.3-2 Forklift Dimensions**

| Forklift | A | A' | B | B' | C | C' | D | D' | H |
|---|---|---|---|---|---|---|---|---|---|
| Small | 5.75" | | 29" | | 48" | | 2" | | 16' |
| (Propane) | (14.605) | | (73.66) | | (121.92) | | (5.08) | | (4.877) |
| Small | 4" | | 22" | | 42" | | 1.5" | | 18' |
| (Electric) | (10.16) | | (55.88) | | (106.68) | | (3.81) | | (5.486) |

**Legend for Table 9.3-2**
A tine width, in (mm)
A' tine width with extensions, in (mm)
B maximum tine separation, in (mm)
B' maximum tine separation with extensions, in (mm)
C tine length, ft-in (m)
C' tine length with extensions, ft-in (m)
D tine thickness, in (mm)
D' tine thickness with extensions, in (mm)
H maximum tine height, ft-in (m)
X distance from fork face to center of gravity of load, ft-in (m)
W weight of load, lbs. (kg)

**Table 9.3-3 Maximum Allowable Load Calculations**

Small (Propane)
(1.3 ft + X ft) x (W lbs) ≤16,500 ft-lbs. (0.396 m + X m) x (W kg) ≤2,285 m-kg.

Small (Electric)

 

(1.75 ft + X ft) x (W lbs) ≤ 9,900 ft-lbs (0.533 m + X m) x (W kg) ≤ 1370 m-kg

## 9.4 SAFETY EQUIPMENT

Astrotech provides a wide range of personnel safety equipment, such as static dissipating devices, liquid propellant vapor monitors, and portable oxygen meters. A comprehensive list and description of other safety equipment is contained in the Astrotech Facility Safety Manual SHI-ASO-M0011.

### 9.4.1 TRANSFER OF SAFETY CONTROL AUTHORITY

Astrotech met the provisions outlined in EWR 127-1 and was granted a Transfer of Safety Control Authority on 8 September 1997. This allows Astrotech full control authority and responsibility for approving all ground safety and hazardous operation procedures affecting facility safety.

### 9.4.2 TAILORED EWR 127-1

Astrotech met the provisions outlined in EWR 127-1 and was granted a Tailored version of EWR 127-1 on 9 June 1998. For a detailed version of Astrotech's Tailored EWR 127-1, contact the Astrotech Safety Engineer.

 

# 10. PROPELLANTS AND GASES

## 10.1 LIQUID PROPELLANTS

### 10.1.1 Procurement (Optional service)

All fuels both mono and bipropellant fuels and oxidizers offered by Astrotech are obtained through San Antonio Air Logistics Center (SA-ALC), Kelly Air Force Base, Texas. Since SA-ALC contracts on a bulk basis to maintain a minimum, 2-year controlled storage inventory of both fuels and oxidizers, the cost of these propellants are less than if the customer obtains the same propellants in small quantities directly from the respective sole U.S. manufacturers, Arch Chemicals, and Cedar Chemical Corporation. Astrotech passes the SA-ALC billed cost of the propellants directly to the customer on a cost plus fee basis.

SA-ALC procures the following drummed hypergolic fuels from Arch Chemicals per the applicable revision of the specifications listed in Tables 10.1.1-1, 10.1.1-2 and 10.1.1-3.

**Table 10.1.1-1 Fuel Specifications and Container Types**

| Propellant | Specification | Container Types |
|---|---|---|
| Monomethylhydrazine (MMH) | MIL-PRF-27404 | 5,30,34,55,& 120-gallon DOT4BW cylinders |
| Hydrazine ($N_2H_4$ ) | MIL-PRF-26536 | 5,30,34,55,& 120-gallon DOT4BW cylinders |
| High-purity hydrazine ($HPN_2H_4$ ) | MIL-PRF-26536 | 5,30,34,55,& 120-gallon DOT4BW cylinders |
| Unsymmetrical Dimethylhydrazine (UDMH) | MIL-PRF-25604 | 55 & 120-gallon DOT4BW cylinders |
| Aerozine-50 (A-50) | MIL-PRF-27402 | 55 & 120-gallon DOT4BW cylinders |

**Table 10.1.1-2 Hydrazine Specification**

| Qualitative Requirements | Monopropellant-Grade | High-Purity |
|---|---|---|
| Specification | MIL-PRF-26536 | MIL-PRF-26536 |
| N2H4 | 98.5% by wt (min) | 99.0% by wt (min) |
| Water | 1.0% by wt (max) | 0.5 to 1.0% by wt (range) |
| Ammonia | N/A | 0.3% by wt (max) |
| Particulate | 1.0 mg/liter (max) | 1.0 mg/liter (max) |
| Chloride | 0.0005% by wt (max) | 0.0005% by wt (max) |
| Density at $77^0$F ($25^0$C) | N/A | N/A |
| Aniline | 0.50% by wt (max) | 0.003% by wt (max) |
| Iron | 0.002% by wt (max) | 0.0004% by wt (max) |
| Nonvolatile residue | 0.005% by wt (max) | 0.001% by wt (max) |
| $CO_2$ | 0.003% by wt (max) | 0.003% by wt (max) |

**Table 10.1.1-3 Monomethylhydrazine Specification**

| Qualitative Requirements | MMH |
|---|---|
| Specification | MIL-PRF-27404 |
| MMH | 98.3% by wt (min) |
| Water (plus soluble impurities) | 1.5% by wt (max) |
| Particulate | 10 mg/liter (max) |
| Density at $77^o$F ($25^o$C) | N/A |
| Nonvolatile residue | N/A |
| MMH assay | 98.3% by wt (min) |

SA-ALC procures the following cylinder (167 gallon) packaged grades of nitrogen tetroxide ($N_2O_4$ ) from Cedar Chemical Corporation per the applicable revision of the specifications listed in Tables 10.1.1-4, 10.1.1-5, and 10.1.1-6.

 

**Table 10.1.1-4 Oxidizer Specifications and Container Types**

| Propellant | Specification | Container Types |
|---|---|---|
| MON-1 | MIL-PRF-26539 | DOT 110A500W |
| MON-3 | MIL-PRF-26539 | DOT 110A500W |
| MON-10 | MIL-PRF-27408 | DOT 110A500W |

**Table 10.1.1-5 Mon-1, Low Iron Specification**

| Qualitative Requirements | Specification |
|---|---|
| Specification | MIL-PRF-26539 |
| $N_2O_4$ + NO | 99.5% by wt (min) |
| NO content | 0.6% (min) to 1.0% by wt (max) |
| Iron | 0.5 ppm by wt (max) |
| Water Equivalent ($H_2O$ + $HNO_3$) | 0.17% by wt (max) |
| Chloride content | 0.040% by wt (max) |
| Particulate | 10.0 mg/liter (max) |
| Nonvolatile residue | 10.0 mg/liter (max) |

**Table 10.1.1-6 Mon-3, Low Iron Specification**

| Qualitative Requirements | Specification |
|---|---|
| Specification | MIL-PRF-26539 |
| $N_2O_4$ + NO | 99.5% by wt (min) |
| NO content | 2.5% (min) to 3.0% by wt (max) |
| Iron | 0.5 ppm by wt (max) |
| Water Equivalent ($H_2O$ + $HNO_3$) | 0.17% by wt (max) |
| Chloride content | 0.040% by wt (max) |
| Particulate | 10.0 mg/liter (max) |
| Nonvolatile residue | 10.0 mg/liter (max) |

### 10.1.2 Controlled Storage

SA-ALC has an established, controlled storage point at Vandenberg, where propellants intended for use at Astrotech are delivered and stored. Storage requirements for propellant must be submitted a minimum of 30 days prior to expected use. This 30-day coordination is required to ensure that the controlled storage inventory does not exceed VAFB established limits.

Upon request from the customer, Astrotech arranges for the appropriate number of containers to be sampled at the controlled storage point prior to intended use at Astrotech. The customer will be billed for the propellants that successfully pass the procurement specification analysis. Contingency sampling of containers should not be requested until it has been determined that the primary containers are not acceptable to the customer.

**Note:** A specific gaseous (gaseous nitrogen or helium) atmosphere can be requested to be established in correlation with sampling to alleviate gas saturation concerns.

Most customers provide their own shipping containers to deliver their propellants to VAFB. SA-ALC can arrange for shipment of these containers as part of their delivery function to controlled storage sites. All non-government owned containers requesting courtesy storage must be accompanied by a memorandum to the specific storage site, identifying the container(s), its contents, intended program, anticipated length of stay at VAFB, and a local Point of Contact (POC) should the container require emergency repairs (e.g., starts to leak). PPRD/ICD data can be used to fulfill the memorandum requirement. Provision of this data is essential to avoid placing the government and Astrotech in an awkward position.

 

Customers who procure their own propellant should arrange for the delivery of the propellant to the Hazardous Storage Facility at VAFB. Propellants must be procured in the U.S. and details of the cylinders should be sent to Astrotech who will arrange for delivery of the propellant to Astrotech for loading operations.

### 10.1.3 Propellant Container Descriptions

Controlled storage propellants (Table 10.1.1-7) are transported from the vendor (or alternate controlled storage points) to VAFB by government-contracted carriers.

The hypergolic fuels are delivered in 5, 30, 34, 55, and 120-gallon DOT4BW, type 304 stainless steel cylinders. The cylinder interfaces consists of two (2) 0.5" KC male fittings. A 15-psi gas atmosphere (typically gaseous nitrogen) is maintained in the cylinders.

The hypergolic oxidizers are normally delivered in DOT-110A500W, 2000-pound, Type 304 stainless steel cylinders. $N_2O_4$ is also available in government-owned 4BW cylinders (55 and 120 gallon capacity). The cylinder interfaces consists of two (2) 0.5" KC male fittings. The addition of a gaseous atmosphere is not required due to the vapor pressure of the oxidizer.

**Table 10.1.1-7 Container Specifications**

| **DOT Spec** | **110A500W** | **4BW** | **4BW** | **4BW** |
|---|---|---|---|---|
| Capacity | 165 gallons | 5-4.5 gallons w 10% ullage | 55 – 50 gallon w/10% ullage | 120 |
| Weight | | | | |
| Tare | 1650 lbs | 44 | 300 lbs | 780 lbs |
| Liquid Full | 3650 lbs | 82 | 720 lbs | 1688 lbs |
| Dimensions | 84” x 30” | 25.5” x 12” | 48.5” x 22” | 48.5” x 36” |
| MAWP | 500 psig | 225 psig | 225 psig | 225 psig |
| Operation Pressure | 0 – 50 psig | Full vacuum to 100 psig | Full vacuum to 100 psig | Full vacuum to 100 psig |
| Interface | CGA 677 | ½” AN | ½” AN | ½” AN |

The information provided in the above table is for reference only. Exact details (i.e., tare weight) and specific interfaces/features (i.e., gas tight head) are dependent on the cylinder's application and the DOT exemption under which the cylinder was manufactured.

The containers must be utilized in accordance with SA-ALC operating and transport pressure limitations. The DOT 4BW cylinders are limited to a maximum operating pressure of 100 psig, DOT-110A500W cylinders are limited to 50 psig as GFE standard. The cylinder transport pressure should nominally be between 5 and 30 psig. A pre-coordinated arrangement can be implemented to increase the maximum operating pressures.

### 10.1.4 Transport of Containers to Astrotech

Transport of the propellant containers from the HSF storage to Astrotech is accomplished by the Vandenberg AFB Hazardous Material Contractor personnel. The request to transport should be made by the customer a week in advance to allow sufficient time for coordination of the activity with VAFB. Due to safety and environmental requirements, the quantity of propellant and duration of container storage at Astrotech shall be minimized. Propellant containers are typically transported to Astrotech three-(3) days prior to use to allow sufficient thermal stabilization. It is highly desirable to return the containers to VAFB or vendor storage as soon as possible following completion of loading operations.

## 10.2 SOLID PROPELLANTS

 

Astrotech will arrange for customer use of certain government facilities and services as required to support solid propellant processing for the mission. All Class A ordnance and solid rocket motors (PKMs and Apogee Kick Motor (AKMs)] will be initially delivered to and stored at VAFB.

The magazine used for storing solid rocket motors is a concrete bunker-type structure located in a remote area on VAFB. The magazine is environmentally controlled to 85 ± 5°F (29.4 ± 2.8°C) and a maximum relative humidity of 65%.

### 10.3 SPECIALTY GASES

Astrotech provides moderate quantities of specialty gases under contract through a local vendor. Deliveries are normally scheduled once a week. Certificates of Compliance (CoC) accompany the cylinders when they are delivered to the point of use. The procured grades, available pressures, volumes, and outlet interfaces are listed in Tables 10.3-1 and 10.3-2:

**Table 10.3-1 Nitrogen Specification**

| **MIL-PRF-27401D Grade Qualitative Requirements** | **A (standard)** | **B (standard)** | **C (optional)** | **UHP (CGA Type 1, Grade A-N) (optional)** |
|---|---|---|---|---|
| Nitrogen (min % v/v) | 99.5 | 99.99 | 99.995 | 99.999 |
| Water, ppm | 26.3 | 11.5 | 5.7 | 3 |
| Total Hydrocarbons, ppm as CH4 | 58.3 | 5.0 | 5.0 | 0.5 |
| Oxygen, ppm | 5000 | 50 | 20 | 1 |
| Hydrogen | No limits | No limits | 0.5 | |
| Argon, ppm | No limits | 20 | 2 | |
| Carbon dioxide | No limits | 5 | 5 | |
| Carbon monoxide, ppm | No limits | 5 | 5 | |
| Particulate, mg/liter | 1.0 | 1.0 | 1.0 | |
| Total Impurities, ppm | 5000 | 100 | 50 | |
| Volume (Standard 'K' bottle) | 230 cf<br>6500 L | 230 cf<br>6500 L | 230 cf<br>6500 L | 230 cf<br>6500 L |
| Volume (High Pressure) | 494 cf<br>13,990 L | 494 cf<br>13,990 L | 494 cf<br>13,990 L | 494 cf<br>13,990 L |
| Pressure (Standard 'K' bottle)<br><br>Cylinder Valve Outlet | 2,200 psi<br>171 bar<br>CGA 580 | 2,200 psi<br>171 bar<br>CGA 580 | 2,200 psi<br>171 bar<br>CGA 580 | 2,200 psi<br>171 bar<br>CGA 580 |
| Pressure (High Pressure)<br><br>Cylinder Valve Outlet | 6,000 psi<br>413 bar<br>CGA 677 | 6,000 psi<br>413 bar<br>CGA 677 | 6,000 psi<br>413 bar<br>CGA 677 | 6,000 psi<br>413 bar<br>CGA 677 |

Building 1032 is supplied by manifolding K-bottles, or supplying single bottles as necessary.

**Table 10.3-2 Helium Specification**

| **MIL-PRF-27407A GRADE Qualitative Requirements** | **A (standard)** | **B (standard)** | **UHP (CGA Type 1, Grade A-C) (optional)** |
|---|---|---|---|
| Nitrogen (min % v/v) | 99.995 | 99.997 | 99.999 |
| Water, ppm | 9 | 9 | 3 |
| Dew point ($^{o}$F @ 70$^{o}$F, 760 mm) | -78$^{o}$F | -78$^{o}$F | -105$^{o}$F |

 

| | | | |
|---|---|---|---|
| Total Hydrocarbons, ppm as CH4 | 58.3 | 5.0 | 0.5 |
| Oxygen, ppm | 3 | 3 | 1 |
| Hydrogen | 1 | 1 | |
| Carbon dioxide | 1 | | |
| Carbon monoxide, ppm | 1 | | |
| Total Impurities, ppm | 50 | 50 | |
| Volume (Standard 'K' bottle) | 230 cf<br>6,500 L | 230 cf<br>6,500 L | 230 cf<br>6,500 L |
| Volume (High Pressure) | 494 cf<br>13,990 L | 494 cf<br>13,990 L | 494 cf<br>13,990 L |
| Pressure (Standard 'K' bottle)<br><br>Cylinder Valve Outlet | 2,200 psi<br>171 bar<br>CGA 580 | 2,200 psi<br>171 bar<br>CGA 580 | 2,200 psi<br>171 bar<br>CGA 580 |
| Pressure (High Pressure)<br><br>Cylinder Valve Outlet | 6,000 psi<br>413 bar<br>CGA 677 | 6,000 psi<br>413 bar<br>CGA 677 | 6,000 psi<br>413 bar<br>CGA 677 |

## 10.4 CONSUMABLES

Upon request, Astrotech can procure technical/specification grade consumables. Product may be procured in: 500 ml bottles, 30-gallon carboys, and 55-gallon drums. Specification data for the more common products are listed in Tables 10.4-1 and 10.4-2.

**Table 10.4-1 Isopropyl Alcohol Specification**

| **Quantitative Requirements** | **Fed Spec TT-I-735, Grade A** | |
|---|---|---|
| | **Minimum** | **Maximum** |
| Acidity (as acetic acid) | -- | 0.002% by weight |
| Distillation Range:<br>Initial boiling point……..<br>Dry point……. | 81.3°C | <br><br>83.0°C |
| Nonvolatile residue (gram per 100 ml) | -- | 0.002 |
| Specific gravity at 20°C | 0.7862 | 0.7870 |
| Water content (percent) | -- | 0.10% by weight |
| Color (platinum cobalt scale) | | 10 |
| **Qualitative Requirements** | | |
| Appearance | Clear/sediment free when examined by transmitted light. | |
| Odor | Isopropyl Alcohol (IPA) shall have characteristic odor of IPA and leave no residual odor after drying on filter paper for 2 hours. | |
| Hydrocarbons | IPA shall be miscible without turbidity when diluted to 10 volumes with distilled water at 20°C | |
| Corrosion | IPA shall not cause pitting nor black stain on a copper strip when tested as specified in Section 4 of TT-I-735. A slight brown stain shall not be cause for rejection | |

**Table 10.4-2 Demineralized Water Specification**

| **Quantitative Requirements** | **JSC SPEC -C-20** | |
|---|---|---|
| | **Minimum** | **Maximum** |
| PH | 6.0 | 7.5 |
| Chlorides (ppm) | - | 1.0 |
| Total solids (mg/l) | - | 2.0 |

| | |
|---|---|
| Conductivity | $1.0 \times 10^{-6}$ ohm $^{-1}$ cm$^{-1}$ at 25$^{o}$C (max) |
| Surface tension | 72.72 1.0 dynes/cm at 20$^{o}$C |

Sodium Hydroxide and Hydrogen Peroxide are available in moderate quantities to support the cleaning if propellant loading equipment after the loading operations is completed.

# 11. DETAILED FACILITY INTERFACES - PPF (BUILDING 1032)

## 11.1 GENERAL DESCRIPTION – BUILDING 1032

Building 1032 consists of two (2) adjoining areas located in hazardous/nonhazardous work area and is referred to as the Payload Processing Facility (PPF). The floor covering in all clean room areas is an electro-static dissipative (ESD) two (2) part epoxy bonded to the concrete slab. The air lock and high bay floors are compatible with the use of either wheeled dollies or air pallets (see Section 9.2). The garment rooms and the control rooms have a vinyl tile floor covering. The floor is built to withstand a floor loading of 3500 psi.

The details of the access doors into the various areas of the Building 1032 are given in the respective figures for each area of the facility. Each steel roll-up door is motorized with a manually-operated, chain-drive backup mechanism. The controls for the doors are located inside each bay. External access points have double roll up doors. Between the two (2) roll-up doors there is a 3/4-inch (20 mm) step down in the concrete slab. Personnel doors are situated beside each roll up door in addition to entry and emergency exit doors within the facility. All personnel entrance doors are secured with a cipher lock mounted on the outside of the door. Emergency exit doors do not have cipher locks. Astrotech personnel will operate the large roll up doors at the request of the customer. This allows Astrotech to ensure that customer's security and cleanliness are not compromised by other users in the facility.

The major areas of Building 1032 as shown in Figure 11.1-1 are:

Air Lock (1)
High Bays (2)
Garment Change Rooms (2)
Control Rooms (2)
Auxiliary Control Room (1)

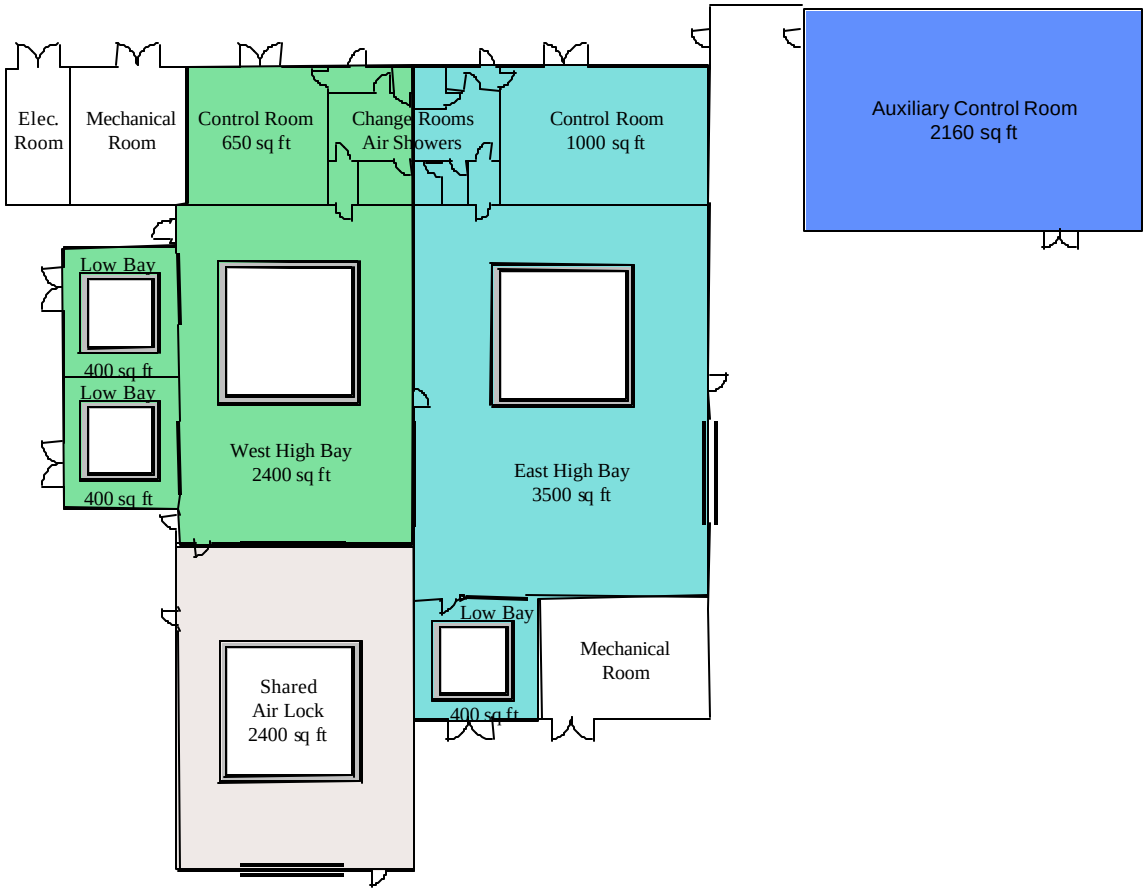


**Figure 11.1-1 Building 1032 Plan View**

## 11.2 COMMON AIR LOCK

The Building 1032 shared air lock (Figure 11.2-1) provides access to both high bay areas. A ten-ton overhead crane supports this area.

Spacecraft containers and associated GSE are offloaded using one (1) of two (2) methods. Items that can be fork lifted will be removed from the transport vehicles either in the air lock or on the adjacent asphalt apron. Under the supervision of the contractor, ASO will place the items in the air lock (where they can later be moved into the relevant high bay) or place them directly in the high bay. Items that cannot be moved by forklift will be offloaded from the transport vehicles by overhead crane. The transport vehicle can be backed directly into either area and offloaded using the overhead traveling bridge crane. A mobile crane may also be used to offload equipment on the adjacent asphalt apron.

Table 11.2-1 summarizes the customer interfaces in the common air lock by type and location.

**Table 11.2-1 Common Air Lock Interfaces**

| Qty | Interface Type | Section Reference |
|---|---|---|
| 4 | Explosion Proof Receptacles | 5.1.2 |
| 5 | 110vac Twist Lock Receptacles | 5.1.2 |
| 2 | Facility Ground | 5.2 |
| 1 | Telephone Extensions | 6.1 |
| 1 | Technical Ground | 5.2 |

| | | |
|---|---|---|
| 1 | 480 vac 30a receptacle | 5.1.2 |
| 1 | 208 vac 60a receptacle | 5.1.2 |
| 1 | Breathing Air Panel – 3 connections | 8.2 |
| 1 | Water Bibb | |
| 4 | Headset Stations – 10 connectors | |

### 11.2.1 Overall Dimensions – Common Air Lock

The dimensions of this room are given in Table 11.2-2, and a plan of the common air lock can be seen in Figure 11.2-2.

**Table 11.2-2 Overall Dimensions – Common (Shared) Air Lock**

| **Length** **Feet (Meters)** | **Width** **Feet (Meters)** | **Height** **Feet (Meters)** | **Crane Hook Height** **Feet (Meters)** | **Crane Capacity** **Tons (Metric Tons)** |
|---|---|---|---|---|
| 60’ (18.288) | 40’ (12.192) | 44’ 2” (12.85) | 35’ 8” (10.87) | 10’ (9.07) |

**Table 11.2-3 Critical Door Dimensions**

| | **Width** **Feet (Meters)** | **Height** **Feet (Meters)** |
|---|---|---|
| Airlock to Outside | 20’ (6.1) | 40’ (12.19) |
| Airlock to West High Bay | 20’ (6.1) | 44’ 2” (13.46) |


**Figure 11.2-1 Common (Shared) Air Lock in Building 1032 – Typical**

 

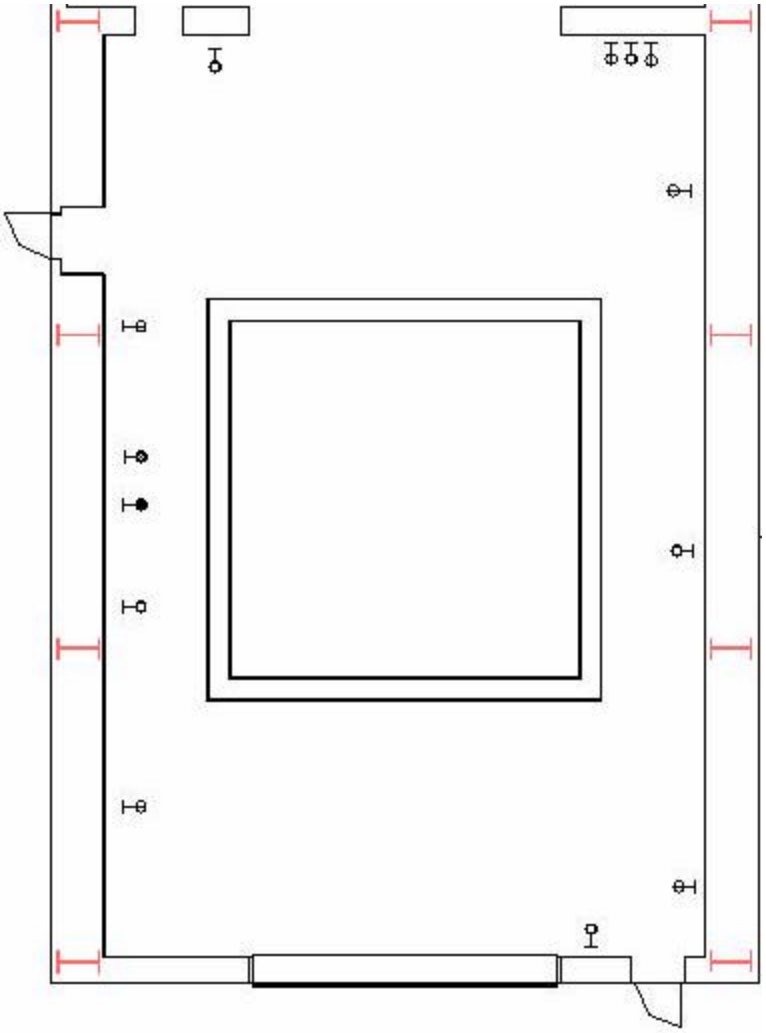

**Figure 11.2-2 Common (Shared) Air Lock in Building 1032 – Layout**

## 11.3 WEST BAY

**Table 11.3-1 West High Bay (Room 106) Interfaces**

| Qty | Interface Type | Section Reference |
|---|---|---|
| 6 | Explosion Proof Receptacles (Appleton) | 5.1.2 |
| 3 | 110vac Twist Lock Receptacles | 5.1.2 |
| 1 | 480 vac 30a | 5.1.2 |
| 1 | Lug Block | |
| 1 | Technical Ground | 5.2.2 |
| 3 | Facility Grounds | 5.2 |
| 2 | Breathing Air Panels – 6 connectors | 8.2 |
| 4 | Headset Panels – 12 headsets connectors | |
| 1 | Water Bibb | |

### 11.3.1 West High Bay

Each high bay has an associated control room from which the spacecraft teams can monitor and control their spacecraft (Figures 11.3-1 and 11.3-2).

Two (2) sets of steel double doors provide access for installation of Electrical Ground Support Equipment (EGSE). These doors can only be opened from inside. Personnel doors with card readers control access into the control room. A window is mounted in the wall between each control room and adjoining high bay to permit direct visual between personnel in the two (2) rooms. Pass throughs in the south wall of the control room allow cables to be routed between the GSE and the spacecraft.

#### 11.3.1.1 Overall Dimensions – West Control Rooms

The dimensions of the control rooms are shown in Table 11.3-2.

**Table 11.3-2 Overall Dimensions – West Control Room**

| **Length**<br>**Feet Meters** | **Width**<br>**Feet (Meters)** | **Height**<br>**Feet (Meters)** |
|---|---|---|
| 23’ 9” (7.239) | 26’ 8” (8.128) | 42’ 8” (13.00) |

**Table 11.3-3 Critical Door Dimensions**

| **Width**<br>**Feet (Meters)** | **Height**<br>**Feet (Meters)** |
|---|---|
| 7’ 11” (2.41) | 7’ 9” (2.13) |

**Figure 11.3-1 West Control Room – Typical**

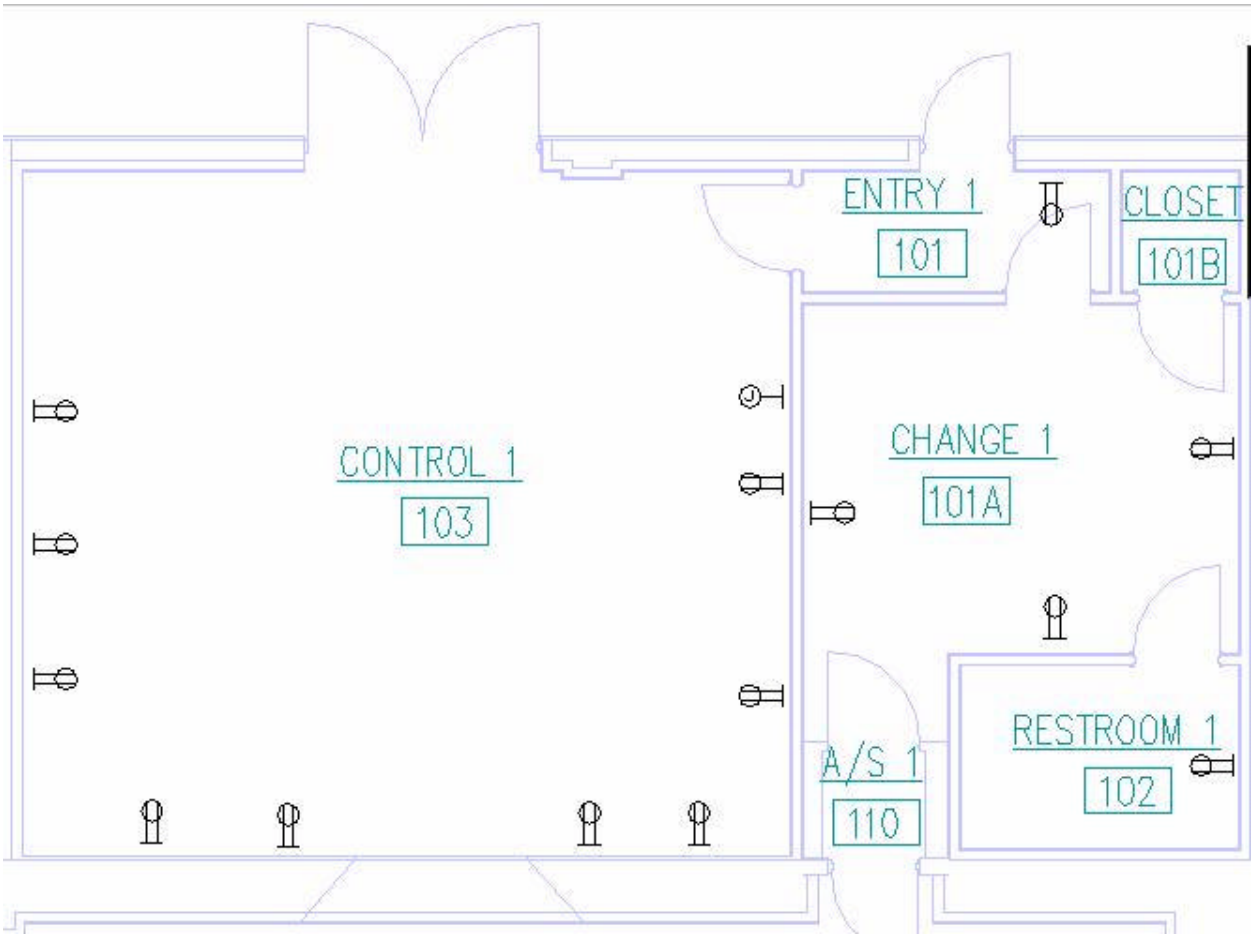


**Figure 11.3-2 West Control Room – Layout**

### 11.3.2 West Control Room

Personnel normally enter each high bay via a garment change room. Each garment change room contains personnel lockers, coat racks, and benches to support storage of, and changing into, clean room garments and shoes/shoe coverings (Figure 11.3-3). A rotary brush shoe cleaner, and an ionized air shower are located in the entry passage to the high bay personnel door. Adjacent to the entry passage is a unisex rest room. Personnel doors are secured with a card reader mounted near the door.

#### 11.3.2.1 Overall Dimensions – Garment Change Rooms (West)

The dimensions of the garment change rooms are shown in Table 11.3-3.

**Table 11.3-3 Overall Dimensions – West Garment Change Rooms**

| **Length** **Feet (Meters)** | **Width** **Feet (Meters)** | Height **Feet (Meters)** |
|---|---|---|
| 12’ 1’ (3.68) | 15’ 3” (4.648) | 8’ 11” (2.717) |

**Figure 11.3-3 West Garment Change Room – Typical**

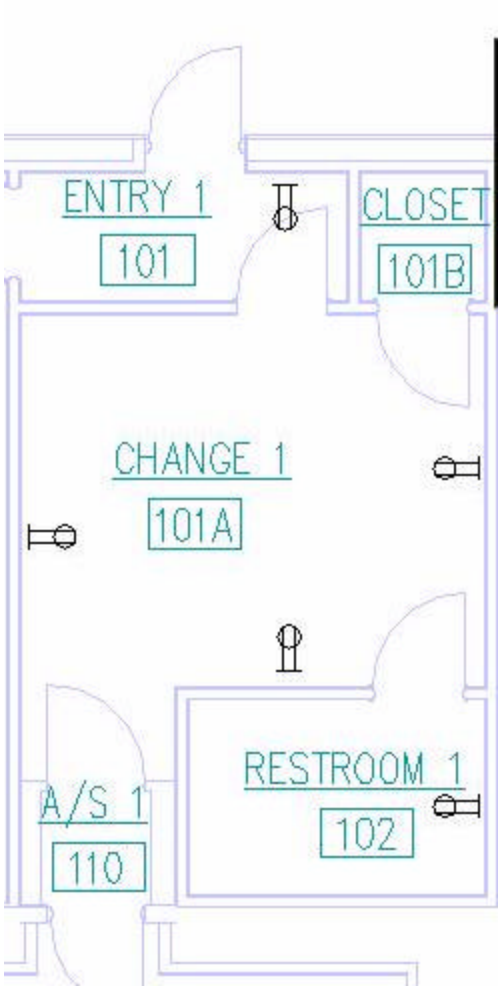


**Figure 11.4-4 West Garment Change Room – Layout**

### 11.3.3 West Low Bay

There are two clean room low bays (Figure 11.3-4) located along the west wall of the west processing high bay. These rooms may be used for supporting propellant loading operations. The fuel containment troughs are sized to contain fuel spills for cleanup. The floor is coated with an ESD epoxy material.

The low bay doors are separated from the high bay by manually operated gear-driven, steel rollup doors. Double steel alarmed doors with panic bars open to the outside. These double wide doors offer an alternative access for moving equipment into or out of each low bay room.

**Table 11.3-1 Overall Dimensions – West Low Bay**

**Table 11.3-2 Critical Door Dimensions**

| | **Width**<br>**Feet (Meters)** | **Height**<br>**Feet (Meters)** |
|---|---|---|
| Low Bay to Outside | 7’ 11” (2.41) | 9’ 9” (2.97) |
| Low Bay to West High Bay | 13’ 7” (4.14) | 10’ (3.05) |

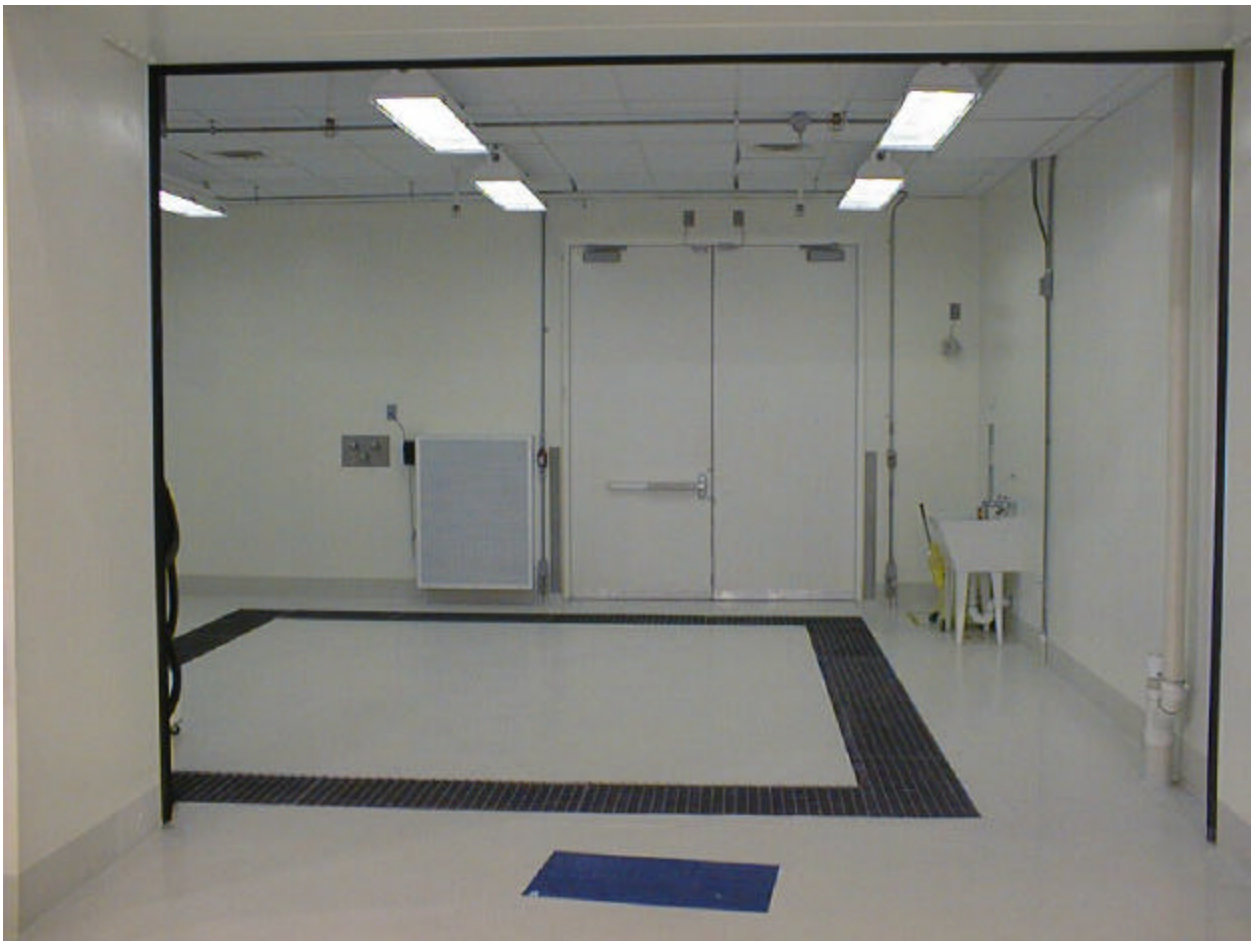

**Figure 11.3-4 Low Bay (West) – Typical**

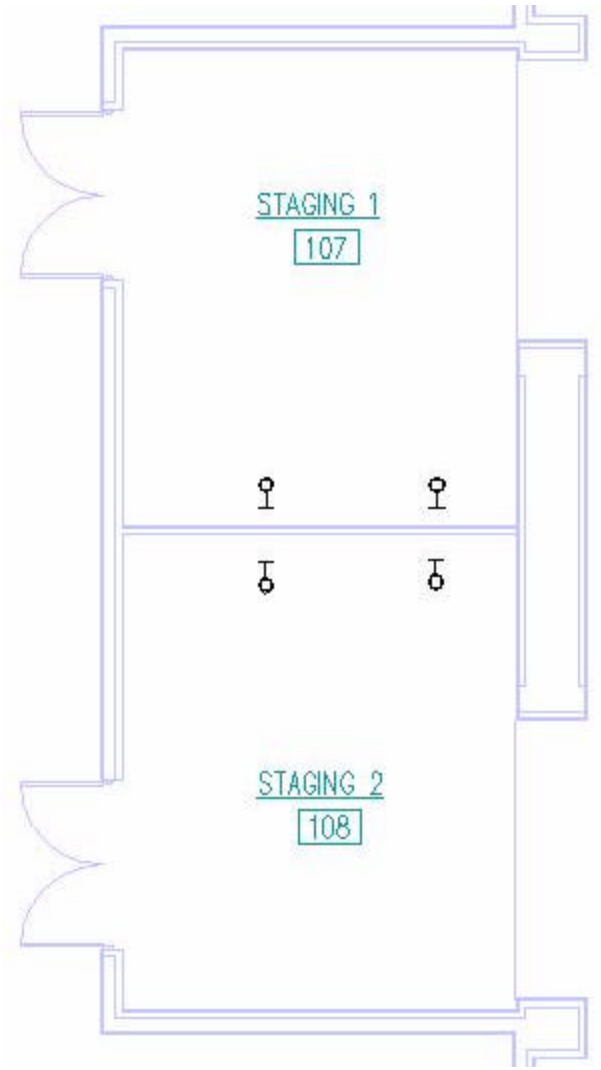


**Figure 11.3-5 Low Bays (West) - Layout**

#### 11.3.3.1 Overall Dimensions – High Bay (West)

The dimensions of the west high bay is shown in Table 11.3-4.

**Table 11.3-4 Overall Dimensions – West High Bay**

| Length Feet (Meters) | Width Feet (Meters) | Height Feet (Meters) | Crane Hook Height Feet (Meters) | Crane Capacity Tons (Metric Tons) |
|---|---|---|---|---|
| 60’ 2” (18.337) | 39’ 8” (12.089) | 44’ 2” (12.85) | 35’ 8” (10.87) | 10’ (9.07) |

**Table 11.3-5 Critical Door Dimensions**

| | Width Feet (Meters) | Height Feet (Meters) |
|---|---|---|
| West High Bay to Airlock | 20’ (6.1) | 44’2” (13.46) |
| West High Bay to East High Bay | 19’ 10” (6.05) | 44’ 2” (12.9) |

**Figure 11.3-4 High Bay (West) in Building 1032 – Typical**

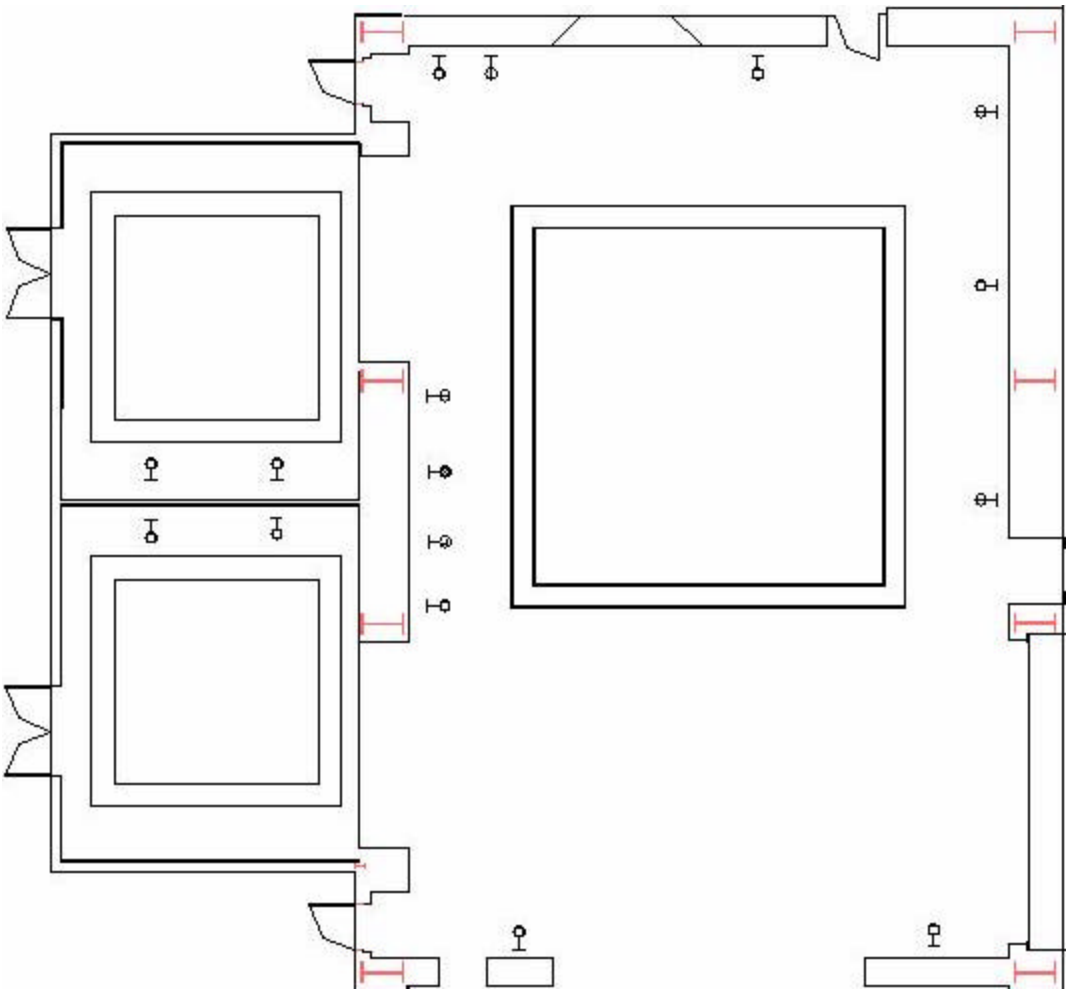

**Figure 11.3-5 High Bay (West) in Building 1032 – Layout**

## 11.4 EAST BAY

### 11.4.1 East Control Room

11.4.1.1 Overall Dimensions – East Control Room

**Table 11.4-1 – Overall Dimensions – East Control Room**

| **Length**<br>**Feet (Meters)** | **Width**<br>**Feet (Meters)** | **Height**<br>**Feet (Meters)** |
|---|---|---|
| 23’ 7” (7.188) | 42’ 5” (12.928) | 8’ 11” (2.717) |

**Table 11.4-2 Critical Door Dimensions**

| **Width**<br>**Feet (Meters)** | **Height**<br>**Feet (Meters)** |
|---|---|
| 7’ 10” (2.39) | 7’ 11” (2.41) |

**Figure 11.4-1 – East Control Room (Typical)**

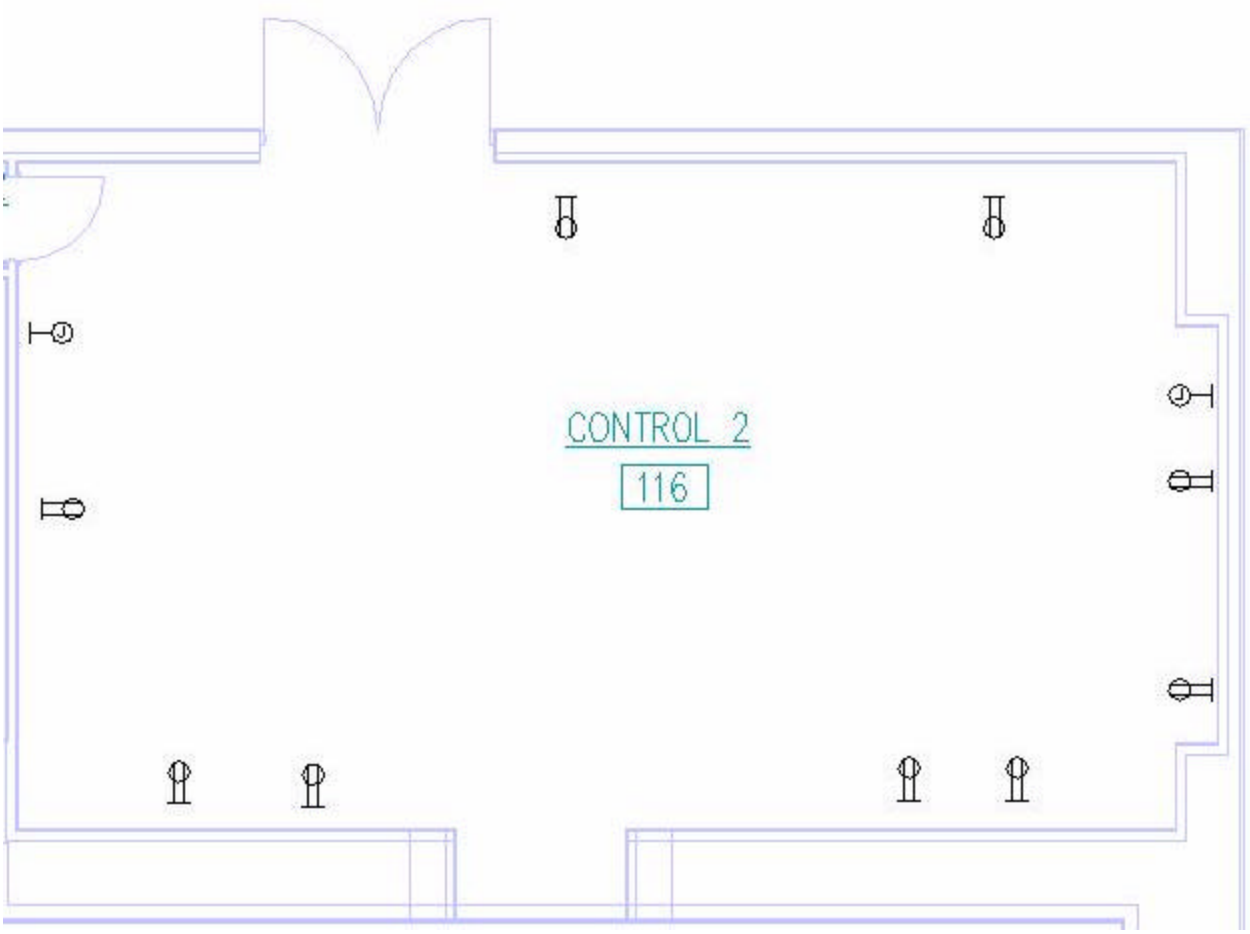


**Figure 11.4-2 – East Control Room (Layout)**

### 11.4.2 East Garment Change Room

11.4.2.1 Overall Dimensions – East Garment Change Room are shown in Table 11.4.2-1

**Table 11.4.2-1 – Overall Dimensions – East Garment Change Room**

| **Length**<br>**Feet (Meters)** | **Width**<br>**Feet (Meters)** | **Height**<br>**Feet (Meters)** |
|---|---|---|
| 7’ 11” (2.413) | 15’ 7” (4.749) | 8’ 11” (2.717) |

**Figure 11.4.2-1 – East Garment Change Room (Typical)**

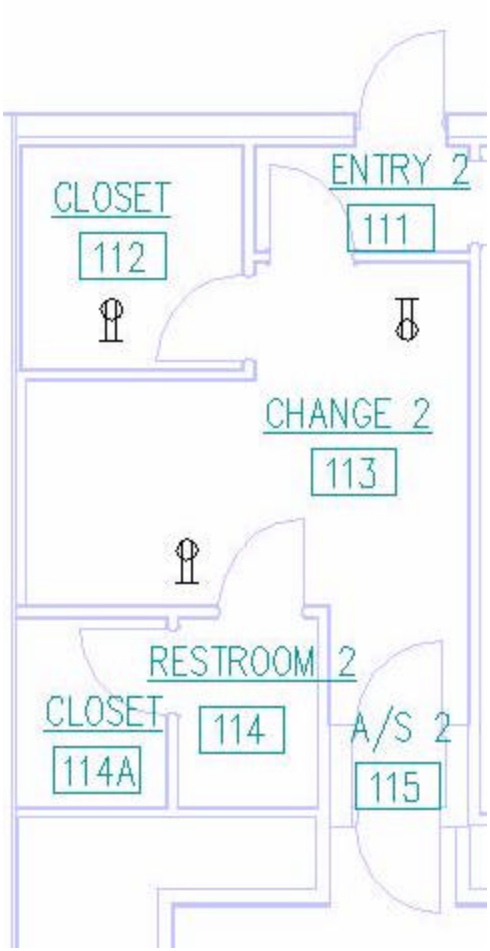


**Figure 11.4.2-2 – East Garment Change Room (Layout)**

### 11.4.3 East Low Bay

11.4.3.1 Overall Dimensions – East Low Bay are shown in Table 11.4.3-1

**Table 11.4.3-1 – Overall Dimensions – East Low Bay**

| **Length**<br>**Feet (Meters)** | **Width**<br>**Feet (Meters)** | **Height**<br>**Feet (Meters)** |
|---|---|---|
| 19’ 6” (5.943) | 23’ 2” (7.059) | 10’ 2” (3.09) |

**Table 11.4.3-2 Critical Door Dimensions**

| | **Width**<br>**Feet (Meters)** | **Height**<br>**Feet (Meters)** |
|---|---|---|
| East Low Bay to Outside | 7’ 10” (2.38) | 9’ 11” (3.04) |
| East Low Bay to East High Bay | 13’ 7” (4.14) | 11’ (3.35) |

**Figure 11.4.3-1 East Low Bay (Typical)**

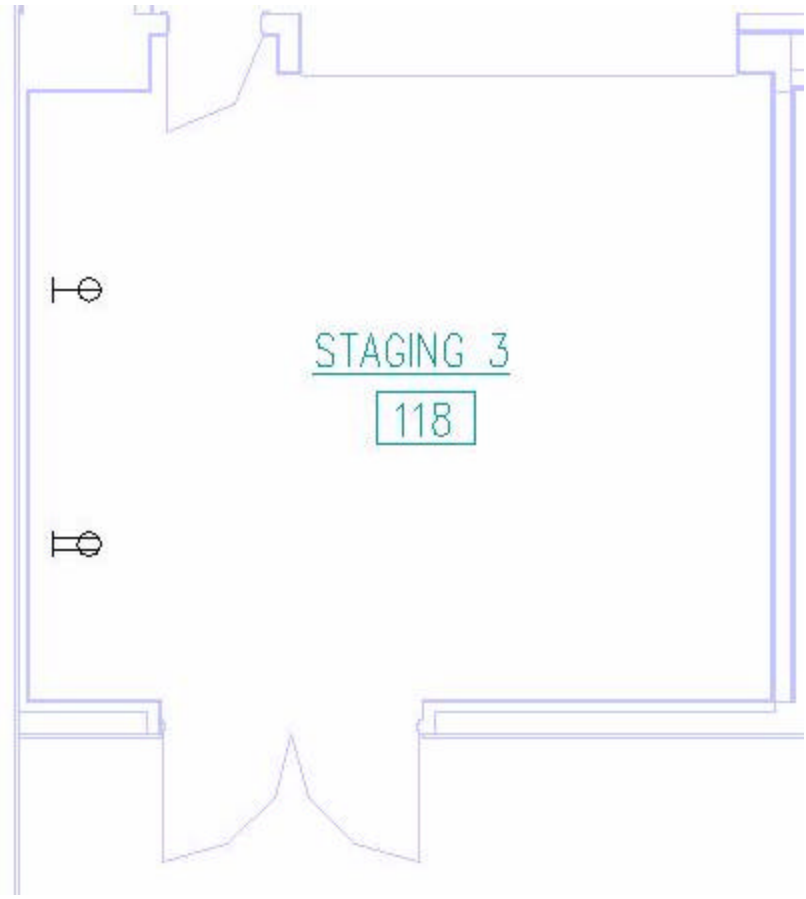

**Figure 11.4.3-2 - East Low Bay (Layout)**

### 11.4.4 East High Bay

11.4.4.1 Overall Dimensions – East High Bay are shown in Table 11.4.4-1

**Table 11.4.4-1 – Overall Dimensions – East High Bay**

| **Length**<br>**Feet (Meters)** | **Width**<br>**Feet (Meters)** | **Height**<br>**Feet (Meters)** | **Crane Hook Height**<br>**Feet (Meters)** | **Crane Capacity**<br>**Tons (Metric Tons)** |
|---|---|---|---|---|
| 71’ 11” (21.92) | 49’ 11” (15.214) | 60’ 7” (18.466) | 54’ 10” (16.712) | 30 (27.216) |

**Table 11.4.4-2 Critical Door Dimensions**

| | **Width**<br>**Feet (Meters)** | **Height**<br>**Feet (Meters)** |
|---|---|---|
| East High Bay to Outside | 19’ 11” (6.07) | 49’ 6” (15.09) |
| East High Bay to West to West High Bay | 19’ 10” (6.05) | 42’ 4” (12.9) |

**Figure 11.4.4-1 – East High Bay (Typical)**

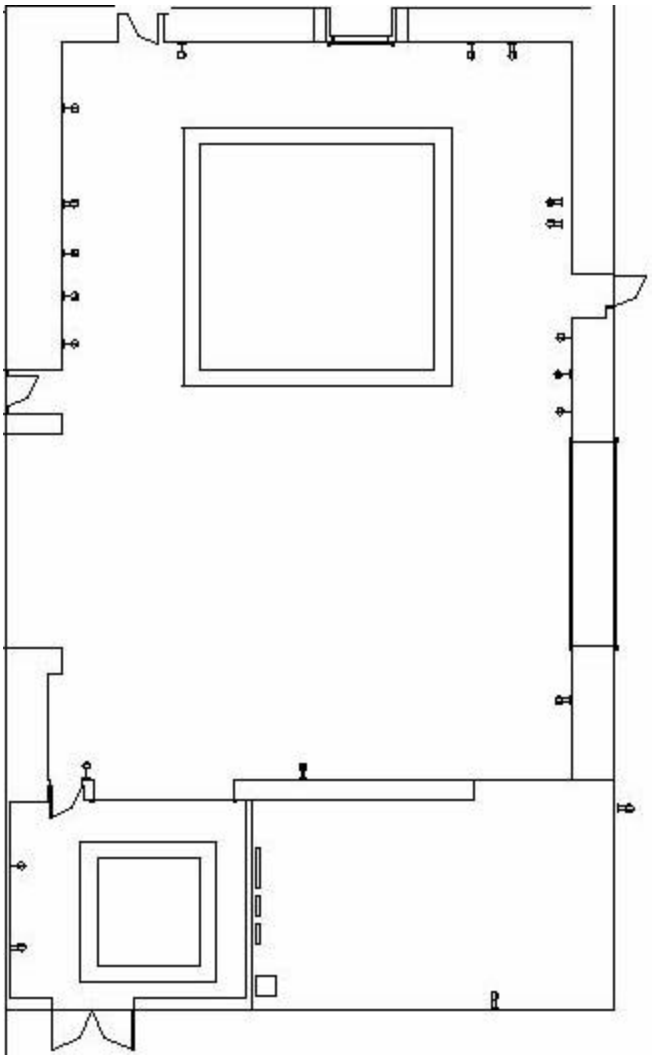

**Figure 11.4.4-2 – East High Bay (Layout)**

## 11.5 AUXILIARY CONTROL ROOM

11.5.1 Overall Dimensions of the ACR are shown in Table 11.5-1

**Table 11.5-1 – Overall Dimensions – Auxiliary Control Room**

| Length<br>Feet (Meters) | Width<br>Feet (Meters) | Height<br>Feet (Meters) |
|---|---|---|
| 60’ (18.288) | 36’ (10.973) | 9’ (2.74) |

**Table 11.5-2 Critical Door Dimensions**

| Width<br>Feet (Meters) | Height<br>Feet (Meters) |
|---|---|
| 6’ 10” (2.11) | 8’ 11” (2.72) |

**Figure 11.5-1 – Auxiliary Control Room (Typical)**

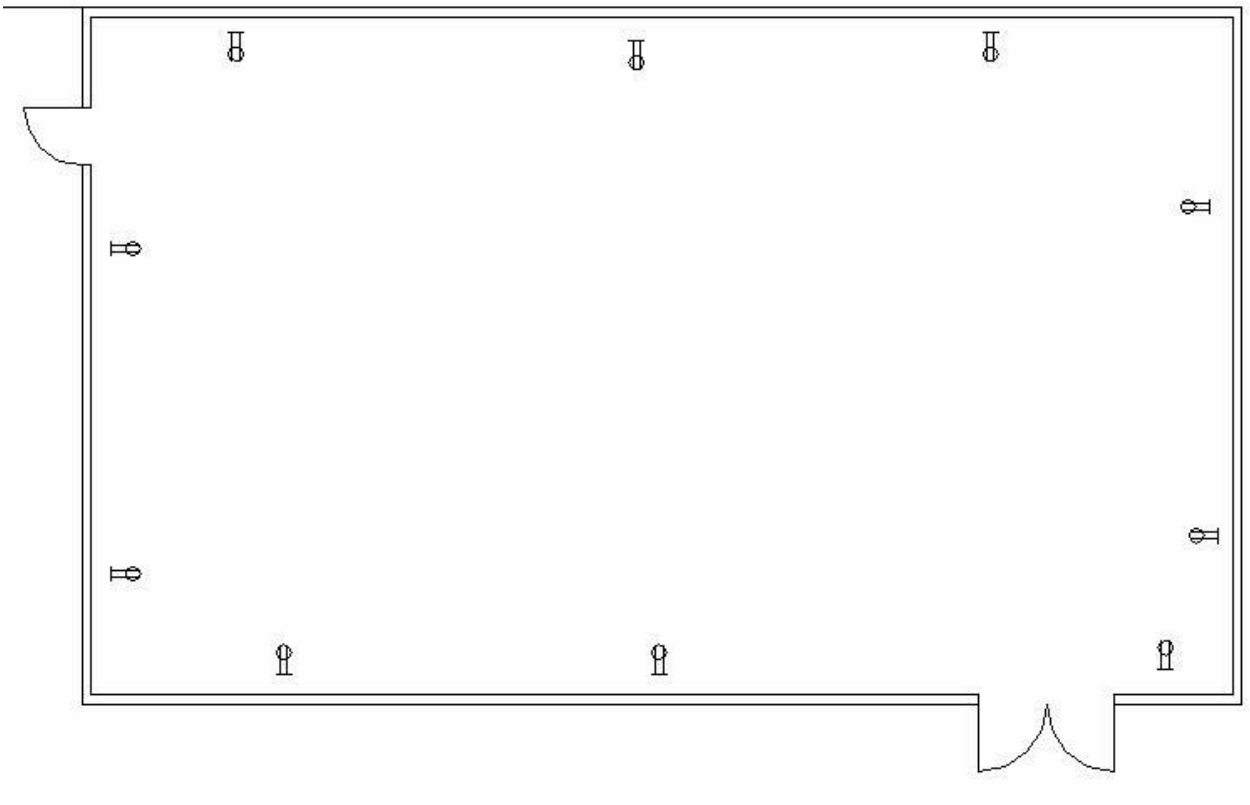

**Figure 11.5-2 – Auxiliary Control Room (Layout)**

## 11.6 ASO ADMINISTRATIVE AND SHARED SUPPORT AREAS BUILDINGS 1030 AND 1036

The remaining areas house the Astrotech resident professional and administrative staff, and shared support areas. The shared support areas include the following:

Reproduction room
Conference rooms (2) - 24 person
Secure conference room (D1) - 40 Person
Break rooms (3) contains a refrigerator, microwave oven, vending machines
Restroom facilities (3)

The first floor Conference Room D1, has been constructed in accordance with the established USAF guidelines for secure conference rooms designed for the discussion and handling of classified material.

Prior arrangements must be made with ASO for classified meetings.

## 12 RESERVED

## 13 RESERVED

# 14. SUPPORT FACILITY DESCRIPTIONS

## 14.1 WAREHOUSE STORAGE FACILITY: BUILDING 1034

Building 1034 (Figure 14.2-1) features a single large warehouse storage area that is protected from the outside weather but not environmentally controlled. The building is used primarily for the storage of Astrotech's forklift trucks and other assets, but is available for storage of customer's empty containers on a shared resource basis.

External access for shipping containers and equipment is provided through a single large exterior door on the north and south end of the storage area. The warehouse storage area does not contain an overhead crane. Offloading of containers and equipment from transportation vehicles is accomplished by forklift.

The remainder of Building 1034 houses an office, workshop, and storage areas for the use of Astrotech staff technical personnel.

The major areas of Building 1034, the warehouse storage facility, are:

- Warehouse Storage Area
- Astrotech Staff

### 14.1.1 Overall Dimensions – Building 1034

The overall dimensions of the building are given in Table 14.2-1.

**Table 14.2-1 Building 1034 Overall Dimensions**

| **Length**<br>**Feet (Meters)** | **Width**<br>**Feet (Meters)** | **Height**<br>**Feet (Meters)** |
|---|---|---|
| | | |

**Table 14.2-2 Critical Door Dimensions**

| | **Width**<br>**Feet (Meters)** | **Height**<br>**Feet (Meters)** |
|---|---|---|
| North Rollup Door | 20' (6.1) | 26' 3" (8.0) |
| South Rollup Door | 20' (6.1) | 26' 3" (8.0) |

## 14.2 TECHNICAL SUPPORT BUILDING: BUILDING 1036

Building 1036 provides office accommodation for the spacecraft customers. The shared support areas in Building 1036 include a kitchenette and restroom facilities.

The building contains 4 individual offices, 2 shared offices, and 2 bull pen areas. Each office is outfitted with one (1) standard office desk and chair. Each bull pen has a card reader for access.

There is a teleconferencing room, outfitted with a small conference table and twelve (12) chairs.

The major areas of Building 1036 are:

- Single Office areas (6)
- Teleconferencing Rooms (1)
- Break Room
- Bull Pens (2)
- Shared Office (2)

### 14.2.1 Overall Dimensions – Building 1036

The overall dimensions of the building are given in Table 14.2-1.

**Table 14.2-1 Building 1036 Overall Dimensions**

| | **Length Feet (Meters)** | **Width Feet (Meters)** | **Height Feet (Meters)** |
|---|---|---|---|
| Overall dimensions | 70’ (21.336) | 80’ (24.384) | |
| Single office area | 9’ 10” (2.99) | 9’ 11” (3.022) | |
| Teleconference area | 15’ 1” (4.597) | 25’ (7.62 | |
| Break Room | 18’ 2” (5.535) | 12’ 5” (3.784) | |
| Shared Office | 16’ 11” (5.156) | 12’ 11” (3.936) | |

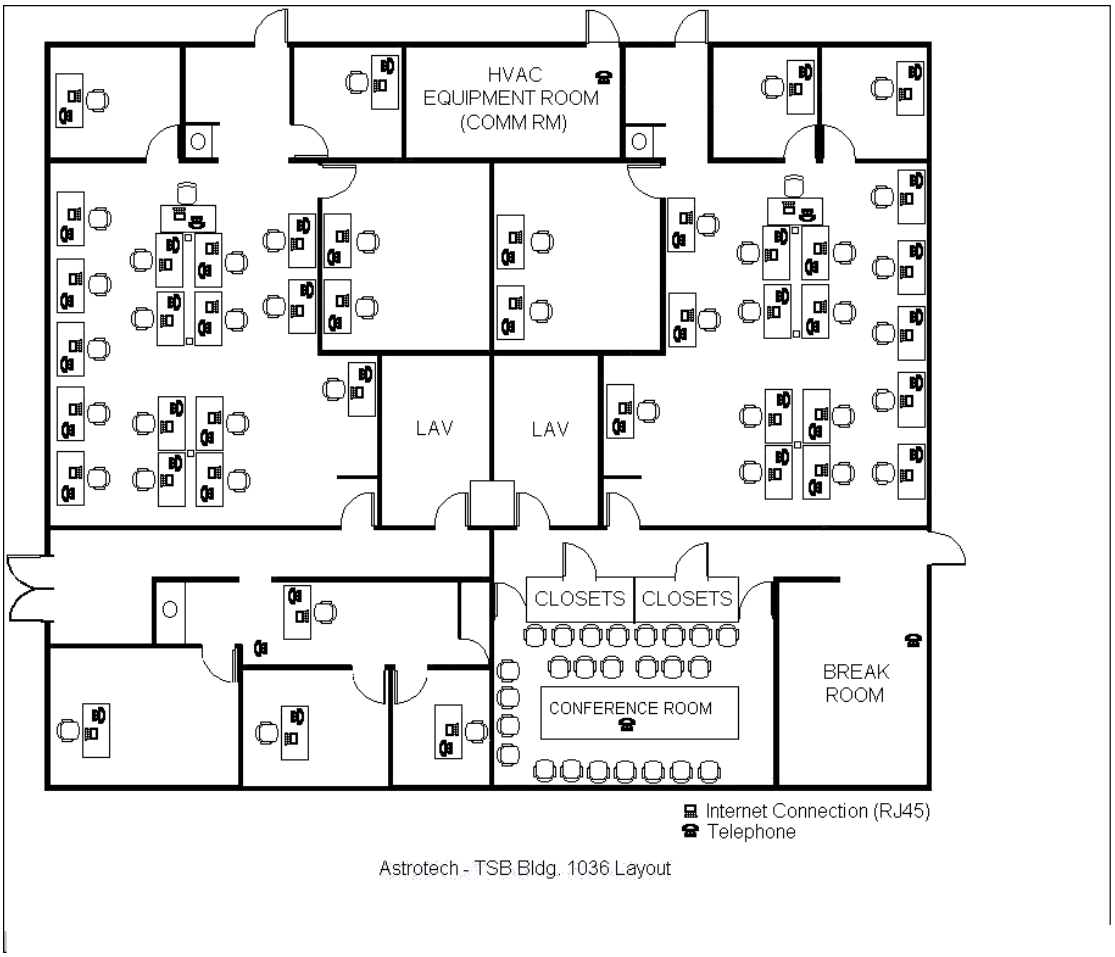


**Figure 14.2-1 Building 1036 Complex – Layout**

### 14.2.2 60 Hz Facility Power – Building 1036

Facility power as described in Section 5.1.1, is available as shown in Figure 14.3-1. The following table summarizes the receptacles supplied in this location.

 

**Table 14.2-2 60 Hz Facility Power – Building 1036**

| Qty | Description | Facility Connector Type | User Connector Type |
|---|---|---|---|
| 92 | 125V/15A/1ϕ | NEMA 5-15R | NEMA 5-15P |

### 14.2.3 Telephone System

Telephone communication as described in Section 6.1 is available. Two (2) digital and 17 analog telephone units are provided. Each digital telephone unit is capable of speed dialing and speakerphone operation.

## 14.3 TECHNICAL SUPPORT BUILDING ANNEX – BUILDING 1030

### 14.3.1 Overall Dimensions

The overall dimensions of the building are given in Table 14.3-1.

**Table 14.3-1 Building 1030 Overall Dimensions**

| Area | Length<br>Feet (Meters) | Width<br>Feet (Meters) | Height<br>Feet (Meters) |
|---|---|---|---|
| Overall | 79’ 9” (24.308) | 32’ 4” (9.854) | |
| Single Office | 15’ 6” (4.724) | 9’ 3” (2.819) | |
| Shared Office | 20’ 1” (6.121) | 19’ (5.791) | |
| Conference Room | 34’ 1” (10.389) | 15’ 5” (4.699) | |
| Bull Pen | 22’ 1” 6.731) | 15’ 4” (4.673) | |
| Lobby | 25’ (7.62) | 15’ 4” (4.673) | |

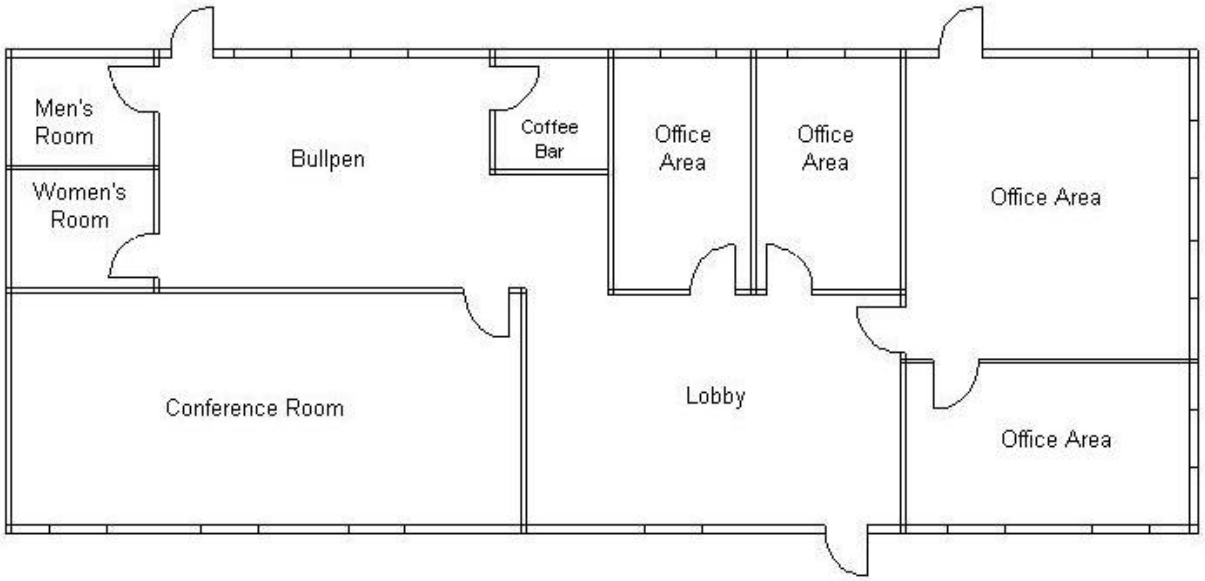


**Figure 14.3.1 Building 1030 Complex – Layout**

### 14.3.2 60 Hz Facility Power – Building 1030

Facility power as described in Section 5.1.1 is available as shown in Figure 14.3-2. The following table summarizes the receptacles supplied in this location.

 

**Table 14.3-3 60 Hz Facility Power – Building 1030**

| Qty | Description | Facility Connector Type | User Connector Type |
|---|---|---|---|
| 65 | 125V/15A/1ϕ | NEMA 5-15R | NEMA 5-15P |